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OF THE
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PRACTICE WITH SCIENCE.

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1862.

These experiments, it is true, are not easy; still they are in the power of every thinking husbandman. He who accomplishes but one, of however limited application, and takes care to report it faithfully, advances the science, and, consequently, the practice of agriculture, and acquires thereby a right to the gratitude of his fellows, and of those who come after. To make many such is beyond the power of most individuals, and cannot be expected. The first care of all societies formed for the improvement of our science should be to prepare the forms of such experiments, and to distribute the execution of these among their members.

Von Thaer, *Principles of Agriculture.*

CONTENTS OF VOL. XXIII.

APPENDIX.

DIRECTIONS TO THE BINDER.

The Binder is desired to collect together all the Appendix matter, with Roman numeral folios, and place it at the *end* of each volume of the Journal, excepting Titles and Contents, and Statistics &c., which are in all cases to be placed at the *beginning* of the Volume: the lettering at the back to include a statement of the *year* as well as the *volume*; the first volume belonging to 1839–40, the second to 1841, the third to 1842, the fourth to 1843, and so on.

In Reprints of the Journal all Appendix matter (and in one instance an Article in the body of the Journal), which at the time had become obsolete, were omitted; the Roman numeral folios, however (for convenience of reference), being reprinted without alteration in the Appendix matter retained.

STATISTICS

OF

THE WEATHER, PUBLIC HEALTH, PRICE OF PROVISIONS, &c., &c.,

FOR THE SIX MONTHS ENDING JUNE 30, 1862.

Chiefly extracted from the Quarterly Report of the Registrar-General.—The Corn Returns and Diagram are prepared from Official Documents expressly for this Journal.

ON

THE METEOROLOGY OF ENGLAND

DURING

THE QUARTER ENDING MARCH 31, 1862.

BY JAMES GLAISHER, ESQ., F.R.S.,

SEC. OF THE BRITISH METEOROLOGICAL SOCIETY.

TILL the 6th of January the temperature of the air was ½° below the average; from the 7th to the 15th 7½° above; then for the next six days 8° below. A period of warm weather followed, extending to the 6th of February; the average daily excess for the 15 days being 8°. From the 7th of February to the 16th was cold, the daily defect of temperature being 3½°. The next six days were in excess to the amount of 8° daily; then from the 24th of February to the 5th of March there was a daily deficiency of 5½°, followed by a period of nine days whose daily average was 7° in excess; this period was succeeded by another ending the 21st of March, of deficient temperature to the amount of 2¼° daily; and from the 21st of March to the end of the quarter there was an excess of temperature to the amount of 6° daily.

The mean high day temperature in January averaged ¾°, and February 1¾° above, whilst in March it was 0°·1 below, their respective averages.

The mean low night temperature in January was 1° nearly, in February 3¼°, and in March 3°, in excess of their respective averages.

The mean temperature of the air was 0°·9 in excess in January, 2½° in excess in February, and 1°·3 in March, as compared with the averages of the preceding 21 years, chiefly due to the warm nights in February.

The mean temperature of the dew-point was 0°·6 below its average in January, 2° above in February, and 2°·9 above in March. The mean for the quarter was nearly 1½° in excess; therefore the amount of water mixed with the air was less in January and greater in February and March.

The mean pressure of the atmosphere in January was 0·06 inch below, in February was 0·12 inch above, and in March 0·29 inch below their respective averages.

The fall of rain in January was 1·9 inch, in February 0·5 inch, and in March 3·7 inches; the total fall for the quarter was 6·1 inches, being about 1¼ inch above the average of the preceding 45 years.

The temperature of vegetation, as indicated by a thermometer placed on grass, was below 30° on 33 nights, and above 30° on 57 nights.

The mean temperature of the air at Greenwich for the three months ending February, constituting the three winter months, was 40°·4, being 2°·6 above the average of the preceding 90 years.

The Weather during the Quarter ending March 31, 1862.

1862. Months.	Temperature of Air. Mean.	Air. Diff. from average of 91 years.	Air. Diff. from average of 21 years.	Evaporation. Mean.	Evaporation. Diff. from average of 21 years.	Dew Point. Mean.	Dew Point. Diff. from average of 21 years.	Air—Daily Range. Mean.	Air—Daily Range. Diff. from average of 21 years.	Elastic Force of Vapour. Mean.	Elastic Force of Vapour. Diff. from average of 21 years.	Weight of Vapour in a Cubic Foot of Air. Mean.	Weight of Vapour. Diff. from average of 21 years.
	°	°	°	°	°	°	°	°	°	in.	in.	grs.	gr.
January	39·0	+2·9	+0·9	37·1	+0·2	34·6	-0·6	9·6	-0·1	·200	-·003	2·3	-0·1
February	41·1	+2·8	+2·5	39·1	+2·1	36·6	+2·0	9·8	-1·6	·217	+·014	2·5	+0·1
March	43·1	+2·2	+1·3	41·5	+2·0	39·5	+2·9	11·6	-3·2	·242	+·024	2·8	+0·3
Mean ..	41·1	+2·6	+1·6	39·2	+1·4	36·9	+1·4	10·3	-1·6	·219	+·012	2·5	+0·1

1862. Months.	Degree of Humidity. Mean.	Degree of Humidity. Diff from average of 21 years.	Reading of Barometer. Mean.	Reading of Barometer. Diff. from average of 21 years.	Weight of a Cubic Foot of Air. Mean.	Weight of a Cubic Foot of Air. Diff. from average of 21 years.	Rain. Amount.	Rain. Diff. from average of 46 years.	Temperature of Water of the Thames.	Reading of Thermometer on Grass. Number of Nights it was At or below 30°.	Between 30° and 40°.	Above 40°.	Lowest Reading at Night.	Highest Reading at Night.
			in.	in.	grs.	grs.	in.	in.	°				°	°
January	85	-4	29·705	-0·064	552	-2	1·9	-0·1	39·4	18	10	3	13·4	43·1
February	84	-1	29·905	+0·122	553	0	0·5	-1·1	43·3	7	15	6	17·0	48·0
March	86	+4	29·498	-0·286	544	-6	3·7	+2·2	44·4	8	13	10	14·0	46·0
Mean ..	85	0	29·703	-0·076	549	-3	Sum 6·1	Sum +1·2	Mean 42·4	Sum 33	Sum 38	Sum 19	Lowest 13·4	Highest 48·0

Note.—In reading this table it will be borne in mind that the sign (−) minus signifies below the average, and that the sign (+) plus signifies above the average

ON

THE METEOROLOGY OF ENGLAND

DURING

THE QUARTER ENDING JUNE 30, 1862.

By JAMES GLAISHER, Esq., F.R.S.,

SEC. OF THE BRITISH METEOROLOGICAL SOCIETY.

THE warm weather which set in on the 24th of March continued only till the 7th of April; the mean daily excess from the 1st of April was 5°. On the 8th of April a cold period set in which continued till the 16th, the mean daily defect being 5°. This was succeeded by a period of very warm weather, which continued, with little exception, until the 8th of June; the mean daily excess of the 53 days ending the 8th of June was 3° nearly. On several days during this period the weather was above its average to large amounts, as on the 25th of April it was 12°·6 in excess; the 4th, 5th, and 6th of May were 8°·5, 11°·1, and 13°·6 in excess. On the 9th of June a cold period set in, which continued till the end of the month, the mean daily defect being greater than 4°. The average temperature for the month of April was 48°·4, being 4° higher than in 1861, and higher than in any April since 1854. That for May was 55°·4, being 3½° higher than in 1861, and higher than any May since 1848. In June it was 56°·3, being 3° lower than in 1861, and lower than any June since 1854.

The mean high day temperature in April was 0°·8 in excess, in May 2° in excess, and in June 4°·1 in defect of their respective averages.

The mean low night temperature in April was 3°·2 above, in May 3°·8 above, and in June 0°·9 below their respective averages.

The mean temperature of the air was 2°·1 in excess in April, 2°·6 in excess in May, and 2°·9 in defect in June; and this is the first month in the present year in which the mean temperature has been below its average.

The mean temperature of the dew-point was 3°·1 in excess in April, 4°·9 in excess in May, and 1°·6 in defect in June; the mean for the quarter was a little more than 2° in excess.

The mean pressure of the atmosphere was 0°·1 inch in excess in April, 0·04 inch in defect in May, and 0·08 inch in defect in June.

The fall of rain in April and May was 2·8 inches in each month, and in June was 1·8 inch. The total fall for the quarter was nearly 7½ inches, exceeding the average of the preceding 43 years by a little more than 1½ inch.

The mean temperature of the air at Greenwich in the three months ending May, constituting the three spring months, was 48°·9, being 2°·5 in excess of the average of the preceding 91 years.

The Weather during the Quarter ending June 30, 1862.

1862. Months.	Temperature of: Air. Mean.	Air. Diff. from average of 91 years.	Air. Diff. from average of 21 years.	Evaporation. Mean.	Evaporation. Diff. from average of 21 years.	Dew Point. Mean.	Dew Point. Diff. from average of 21 years.	Air—Daily Range. Mean.	Air—Daily Range. Diff. from average of 21 years.	Elastic Force of Vapour. Mean.	Elastic Force of Vapour. Diff. from average of 21 years.	Weight of Vapour in a Cubic Foot of Air. Mean.	Weight of Vapour in a Cubic Foot of Air. Diff. from average of 21 years.
	°	°	°	°	°	°	°	°	°	in.	in.	grs.	gr.
April	48·4	+2·6	+2·1	45·8	+2·5	43·0	+3·1	15·8	-2·4	·277	+·030	3·1	+0·2
May	55·4	+2·9	+2·6	52·8	+3·7	50·3	+4·9	18·5	-1·8	·365	+·065	4·0	+0·6
June	56·3	−1·8	−2·9	52·7	−2·1	49·3	−1·6	17·8	-3·1	·352	−·022	4·0	−0·2
Mean ..	53·3	+1·2	+0·6	50·4	+1·3	47·5	+2·1	17·3	-2·4	·331	+·024	3·7	+0·2

1862. Months.	Degree of Humidity. Mean.	Degree of Humidity. Diff. from average of 21 years.	Reading of Barometer. Mean.	Reading of Barometer. Diff. from average of 21 years.	Weight of a Cubic Foot of Air. Mean.	Weight of a Cubic Foot of Air. Diff. from average of 21 years.	Rain. Amount.	Rain. Diff. from average of 43 years.	Temperature of Water of the Thames.	Reading of Thermometer on Grass. Number of Nights it was At or below 30°.	Between 30° and 40°.	Above 40°.	Lowest Reading at Night.	Highest Reading at Night.
			in.	in.	grs.	grs.	in.	in.	°				°	°
April	81	+2	29·847	+0·100	545	+3	2·8	+1·0	50·5	5	12	13	20·5	48·0
May	84	+8	29·726	−0·044	534	−4	2·8	+0·7	58·0	0	5	26	30·6	54·5
June	77	+3	29·718	−0·075	533	+2	1·8	−0·1	60·2	0	6	24	35·4	53·0
Mean ..	80	+4	29·763	−0·006	537	0	Sum 7·4	Sum +1·6	Mean 56·2	Sum 5	Sum 23	Sum 63	Lowest 20·5	Highest 54·5

Note.—In reading this table it will be borne in mind that the sign (−) minus signifies below the average, and that the sign (+) plus signifies above the average.

STATE OF THE PUBLIC HEALTH.

1*st Quarter.*—The total number of deaths registered in the quarter was 122,192; it was not so great as in the same quarter of 1860, when the number was 122,617. The rate of mortality in England and Wales in the quarter was 2·447 per cent.; the average being 2·489. It ranged in the March quarter of the previous ten years from 2·2 to 2·9. In the town districts the mortality was 2·691 per cent. against an average of 2·709. In the country districts the rate was 2·209, against an average of 2·297. The country was not only favourably distinguished from town by having a lower rate of mortality, but appears to have attained a higher degree of salubrity as compared with the winters of former years.

2*nd Quarter.*—The total number of deaths registered in the three months was 107,555. In the same period of 1860 and 1861 the numbers were respectively 110,869 and 107,721; whence it appears that in an increasing population the deaths decreased in the last two spring quarters. The annual rates of mortality in these three seasons were 2·237 per cent.; 2·150; 2·124. The average obtained from returns in ten years is 2·201 per cent. The mortality in the town districts was 2·282; in the country districts 1·968. Their respective averages were 2·366 and 2·056, so that the benefit was equally shared between town and country.

PRICE OF PROVISIONS.

1*st Quarter.*—The average price of wheat per quarter was 60*s.*; it was higher than it had been in any quarter since 1856. In the March quarter of 1860 and 1861 the price was 44*s.* 5*d.* and 55*s.* 1*d.* Potatoes were not cheap; they were on an average 142*s.* 6*d.* per ton. Beef was at the same price as in the same period of last year; mutton was a penny per lb. cheaper.

2*nd Quarter.*—The average price of wheat per quarter was 56*s.* 8*d.* It was higher than that of the same period in either of the two previous years. The mean price of beef sold by the carcase at Leadenhall and Newgate markets was 5*d.* per lb.; the best quality was 6*d.*, and cheaper than it had been, taking the average quarterly prices, for a considerable time. The highest and lowest prices of mutton, if the means are taken, were 5*d.* and 7*d.*, and were lower than the prices of the June quarter in the last two years. Potatoes were very dear, the average price of the best at the Waterside Market, Southwark, being 190*s.* per ton.

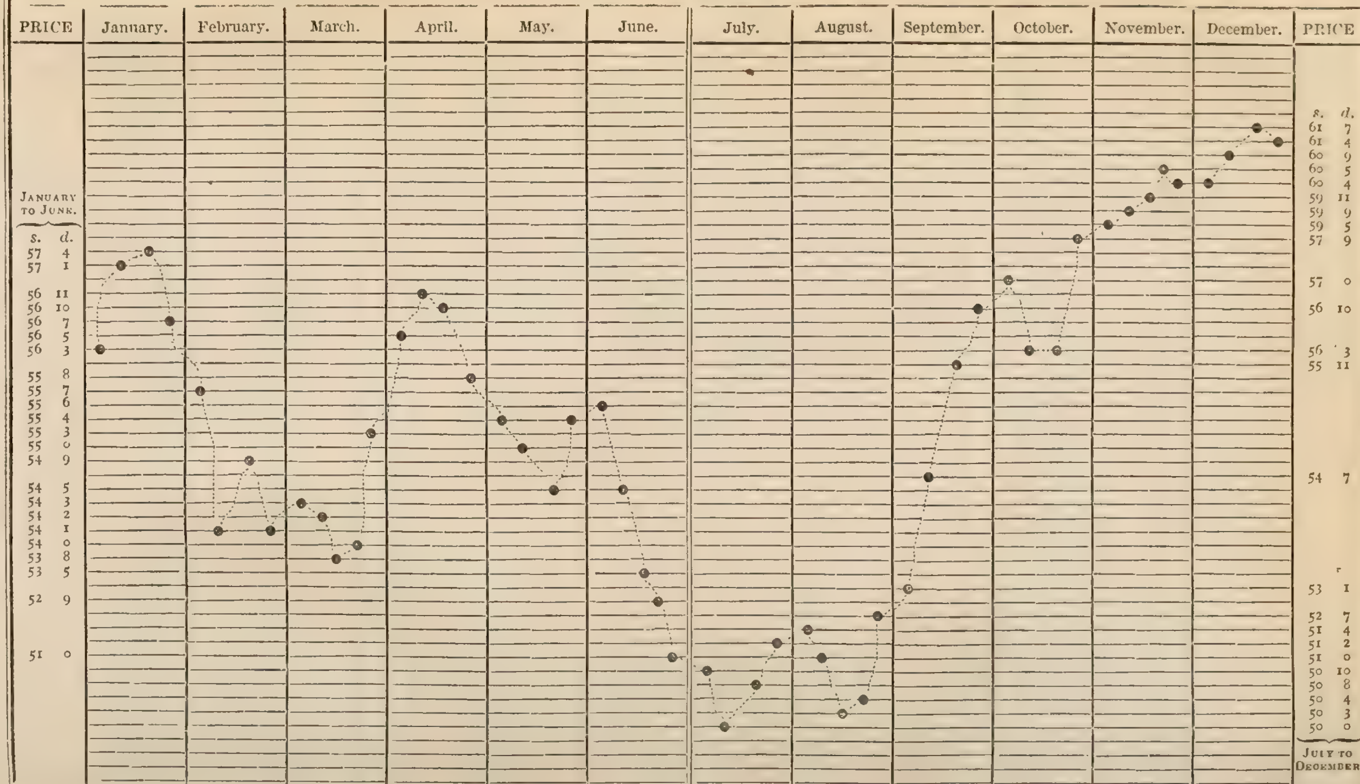
THE PRICE OF PROVISIONS.

The AVERAGE PRICES of Consols, of Wheat, Meat, and Potatoes; also the AVERAGE QUANTITY of Wheat sold and imported weekly, in each of the Nine Quarters ending June 30, 1862.

Quarters ending	Average Price of Consols (for Money).	Average Price of Wheat per Quarter in England and Wales.		Wheat sold in the 290 Cities and Towns in England and Wales making Returns.*	Wheat and Wheat Flour entered for Home Consumption at Chief Ports of Great Britain.*	Average Prices of		
				Average number of Quarters weekly.		Meat per lb. at Leadenhall and Newgate Markets (by the Carcase). Beef.	Mutton.	Best Potatoes per Ton at Waterside Market, Southwark.
1860	£.	s.	d.					
June 30	$94\frac{7}{8}$	52	8	101,106	62,272	$4\frac{3}{4}d.$—$6\frac{3}{4}d.$ Mean $5\frac{3}{4}d.$	$5\frac{1}{2}d.$—$7\frac{1}{2}d.$ Mean $6\frac{1}{2}d.$	125*s.*—160*s.* Mean 142*s.*6*d.*
Sept. 30	$93\frac{1}{4}$	59	1	66,539	139,142	$4\frac{1}{4}d.$—$7d.$ Mean $5\frac{5}{8}d.$	$5\frac{1}{4}d.$—$7\frac{1}{2}d.$ Mean $6\frac{3}{8}d.$	125*s.*—145*s.* Mean 135*s.*
Dec. 31	$93\frac{1}{4}$	56	9	73,770	197,396	$3\frac{1}{2}d.$—$6\frac{1}{4}d.$ Mean $4\frac{7}{8}d.$	$4\frac{3}{4}d.$—$6\frac{3}{4}d.$ Mean $5\frac{3}{4}d.$	115*s.*—130*s.* Mean 122*s.*6*d.*
1861 Mar. 31	$91\frac{3}{4}$	55	1	69,588	145,880	$4d.$—$6\frac{1}{4}d.$ Mean $5\frac{1}{8}d.$	$5\frac{1}{2}d.$—$7\frac{3}{4}d.$ Mean $6\frac{5}{8}d.$	140*s.*—155*s.* Mean 147*s.*6*d.*
June 30	$91\frac{3}{4}$	54	9	65,176	134,085	$4\frac{1}{4}d.$—$6\frac{1}{2}d.$ Mean $5\frac{3}{8}d.$	$5\frac{1}{4}d.$—$7\frac{1}{4}d.$ Mean $6\frac{1}{4}d.$	120*s.*—140*s.* Mean 130*s.*
Sept. 30	$91\frac{3}{8}$	52	1	82,383	128,336	$4\frac{1}{4}d.$—$6\frac{1}{2}d.$ Mean $5\frac{3}{8}d.$	$4\frac{7}{8}d.$—$7d.$ Mean $5\frac{7}{8}d.$	85*s.*—110*s.* Mean 97*s.* 6*d.*
Dec. 30	$93\frac{2}{8}$	59	3	112,809	121,480	$4d.$—$6\frac{1}{4}d.$ Mean $5\frac{1}{8}d.$	$4\frac{3}{4}d.$—$6\frac{3}{4}d.$ Mean $5\frac{3}{4}d.$	110*s.*—130*s.* Mean 120*s.*
1862 Mar. 31	$93\frac{1}{8}$	60	1	74,163	132,882	$4d.$—$6\frac{1}{4}d.$ Mean $5\frac{1}{8}d.$	$4\frac{3}{4}d.$—$6\frac{1}{2}d.$ Mean $5\frac{5}{8}d.$	130*s.*—155*s.* Mean 142*s.*6*d.*
June 30	$93\frac{6}{8}$	56	8	58,728	136,230	$4d.$—$6d.$ Mean $5d.$	$5d.$—$7d.$ Mean $6d.$	180*s.*—200*s.* Mean 190*s.*
Col.	1	2		3	4	5	6	7

* NOTE.—The total number of quarters of wheat sold in England and Wales for the 13 weeks ending June 30th, 1860, was 1,314,386; for the 13 weeks ending September 30th, 1860, 865,007; for the 13 weeks ending December 31st, 1860, 959,006; for the 13 weeks ending March 31st, 1861, 904,649; for the 13 weeks ending June 30th, 1861, 847,285; for the 13 weeks ending September 30th, 1861, 1,070,985; for the 13 weeks ending December 31st, 1861, 1,466,525; for the 13 weeks ending March 31st, 1862, 964,121; and for the 13 weeks ending June 30th, 1862, 763,463. The total number of quarters entered for Home Consumption was respectively, 809,535; 1,808,848; 2,566,145; 1,896,435; 1,743,100; 1,668,374; 1,579,241; 1,727,464; and 1,770,998.

1861.—WEEKLY AVERAGE PRICE OF **WHEAT** FROM GOVERNMENT RETURNS.



	WHEAT.	BARLEY.	OATS.	BEANS.	PEAS.	MAIZE.	FLOUR AND MEAL.
Average of Year	55/5	36/4	23/10	42/5	41/2	..	..
	qrs.	*qrs.*	*qrs.*	*qrs.*	*qrs.*	*qrs.*	*cwt. qrs. lbs.*
Import of United Kingdom	6,966,844	1,405,980	1,875,574	564,477	402,932	3,106,595	6,331,375 1 13

JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

I.—*On the Economical Application of the Liquid Manure of a Farm.* By JAMES T. BLACKBURN.

THE saving and application of liquid manure has for some years past been the subject of much discussion, and I believe that next to the first principles of good cultivation, there are few subjects so important to the progress of agriculture as the consideration of its efficient and economical distribution. On several farms in England and Scotland arrangements have been made for that purpose, but they have not all met with that success which should follow from the recognition and adoption of correct principles. Doubtless many are deterred from adopting the system of pipe distribution by the reports which have been widely circulated, that on those farms where it was carried on, although the crops raised were very large, the pecuniary success was but partial, whilst among the hundreds who visited and inspected the operations, few have cared to investigate the matter for themselves, or to ascertain whether the result was due to an error in principle, or to the want of skill and judgment in carrying out that principle. The liquid portion of manure has been considered by many to be the most valuable, and yet it has been the most generally wasted; until lately the farmer has often complacently given his yearly cheque for large quantities of guano and other concentrated manures, whilst he was making no efforts to prevent the escape of a fertilizer which would have enabled him to dispense in some measure with those expensive adjuncts.

There are not many who have given attention to the subject of liquid manure, but have discovered that, to insure success, other appliances more powerful and effectual than the horse and cart must be resorted to. The dilution necessary to the complete development of its advantages renders that plan unsatisfactory on the score of expense; pipes and pressure therefore at once suggest themselves as the most economical means of conveyance from the tank to the field.

Although it may not be worth while to put up an engine for

this branch of farm work only, where one already exists irrigation will be the means of providing it with profitable employment, when its busy autumn and winter work of threshing, chaff-cutting, root-pulping, cake-crushing, grinding, &c., being over, it would otherwise be idle. Even the season for cultivation by steam will then be drawing to a close, therefore the farm can afford to supply the engine at a low rate of charge ; and a steam-engine is made profitable in proportion to the number of days' work which it is made to perform during the year.

When the position of the ground suggests gravitation, as the power to be made use of in carrying out the system, a pressure of 40 feet (representing the difference of level between the tank and the field) may be looked on as a minimum for the purpose, it being borne in mind that the less the pressure is, the larger must be the pipes laid down to convey a given quantity of fluid. If water is the motive power on a farm I would rather erect pumps than avail myself of gravitation, as the latter power very frequently involves long up-hill carriage of the produce from the field to the stall, besides an additional quantity of piping.

The error into which many have fallen of laying down pipes over a greater extent of land than can pretty constantly be worked through the season, must be avoided, as the portion used will have to be charged with the yearly interest due on the whole capital expended ; the area operated upon must evidently depend on the amount of water at command, and the rotation to be adopted on the land so laid out, which should comprise the greatest number of those crops to which the liquid can be profitably applied—crops which are capable of yielding the largest returns from such an application, and consequently leave the greatest quantity of manure at our disposal. The ground intended for the purpose should be immediately adjacent to the farm buildings, so as to economise the piping, as also the cartage of a large weight of produce to the stall. The description of soil is of little moment, so that it be thoroughly drained. I have obtained equally good results from heavy clay as from a black loam or sandy soil. The most important supply of liquid will be derived from the cattle, and for its effectual collection stall-feeding is the best system to follow.

The floor on which the animals stand should be made of planks raised six or seven inches ; the ground may be covered with asphalt, having a slope towards the channel behind the cattle, which conveys the liquid to the tank ; the sparred floor is so constructed as to require only a small portion of straw on its surface for litter, while it readily allows the liquid to run through and make its way into the channel, at the lower end of which it is taken through a grating into the tank. I prefer a boarded

floor used in this way for many reasons: it forms a warmer bed than any other material, being a much better non-conductor of heat than stone or tile, and the liquid is enabled to separate and flow off more quickly than when it has to find its way among straw in a compressed state, on a sloped stone floor; it is, therefore, from this circumstance also a drier bed than any other at present in use. By this plan but little liquid is absorbed by the straw, which is an important consideration in farm management, since it has been shown theoretically, and confirmed by practice, that straw is so much more valuable for feeding purposes than for litter, that a cheaper substitute as an absorbent or vehicle for the liquid manure should be made use of. This is a question of general economy, quite independent of the mode of using the liquid afterwards. The primary and indispensable preliminary for carrying out this process of irrigation, is the securing an ample supply of water. This supply will be required not only for the purpose of diluting the liquid manure, but also to furnish additional dressings of water, so that the soil may never be parched at the early stage of growth in the crop. From calculations which will be given in detail further on, it will appear that, in connexion with two large tanks, containing 25,000 gallons a-piece, and a small extra tank, holding 5000 gallons, a stream furnishing a constant yield of 7½ gallons per minute will meet all the requirements of 10 acres of irrigated land.* This is on the supposition that irrigation will be carried on one day out of three, or to the same extent working only half a day at a time. Any less run than this will require more complicated arrangements or the less perfect application of this system. In many cases this supply can be obtained by tapping and collecting springs from a higher level, also by making use of the outfall from as many drains as possible, which, instead of being carried away indiscriminately, should be taken into one main drain and then led along the level into the tanks, or to some spot within reach of the pumps. The surface-water can in many parts be collected and turned to account, or a good supply may be had by sinking a well. The peculiarities of the situation must, in each case, determine the course to be preferred.

For the sake of giving a consistent and detailed view of the course of action which I recommend, it is advisable for me to take a special example which may be readily modified so as to adapt it to occupations of various sizes. Let us then from a farm of 150 or 200 acres lay off a square of 20 acres as the proportion

* This supply will provide not only for the irrigation of three acres per week with dilute summer-dressings, but also for a copious application of pure water to two acres; at this rate one week's supply will dilute nearly all of the proposed winter's stock, *if it be really expedient to let this accumulate.*—P. H. F.

to be worked on the liquid manure system; the ground should be level on the surface (not in high ridges), and divided into four 5-acre fields; supposing the liquid has to be forced through the pipes by pumps, two will be required with plungers of $5\frac{1}{4}$ inches diameter, having a stroke of 2 feet, with a speed of 20 revolutions per minute, and throwing 70 gallons per minute.*

The plungers should be of cast-iron, the valves of brass, and so placed as to be easily accessible in case of requiring examination; a small brass cup connected by a cock to the barrel of the pump, close under the stuffing-box, will be found useful to prevent the accumulation of air in the pumps, and also to facilitate their starting. A large air-vessel should be placed on the delivery-pipe, as close to the pumps as possible, and a safety-valve as well. I need not suggest an arrangement of pumps, &c., as I presume in an undertaking of this sort most men would place themselves under the guidance of a person experienced in such matters. The centrifugal pump would be a most economical and efficient machine for this purpose; under ordinary pressure it performs a greater percentage of work in proportion to the power employed than can be got out of the common lift and force pump; the economy of first cost, as well as of power,—the absence of all valves and air vessels,—ease of motion and freedom from jerks,—the almost total impossibility of stoppages from choking (some solid substances of moderate size can be forced through with perfect impunity),—these are advantages which should command an extensive employment of these pumps.

When the supply of water cannot be made to flow naturally into the tanks, the pumps must be looked to for raising the supply needed; an additional suction-pipe and cocks will generally effect this. A branch-pipe from the rising main should be taken into both the tanks; and by a simple arrangement of stop-cocks, water or liquid manure may occasionally be discharged into either tank with such force, before or during the time of pumping out, that little sediment will remain behind.

The fluid should only be charged with that amount of matter in suspension which is due to its bulk. It is a mistake to put on the liquid in a thick state, as it not only stops up the pores of the soil by forming an incrustation on the surface, but is also in an unfit state for immediate assimilation by the plants. The chief value of liquid manure arises from its prompt action and imme-

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* There are many advantages in having a good long stroke, as with the same power the number of strokes made in a given time is thereby diminished, and therefore the inertia of the fluid less frequently to be overcome; the quantity of water which at each closing of the fixed valve returns below it is less, and the shakings in the joints of the mechanism, which are produced by changes in the direction of the motion, are decreased.

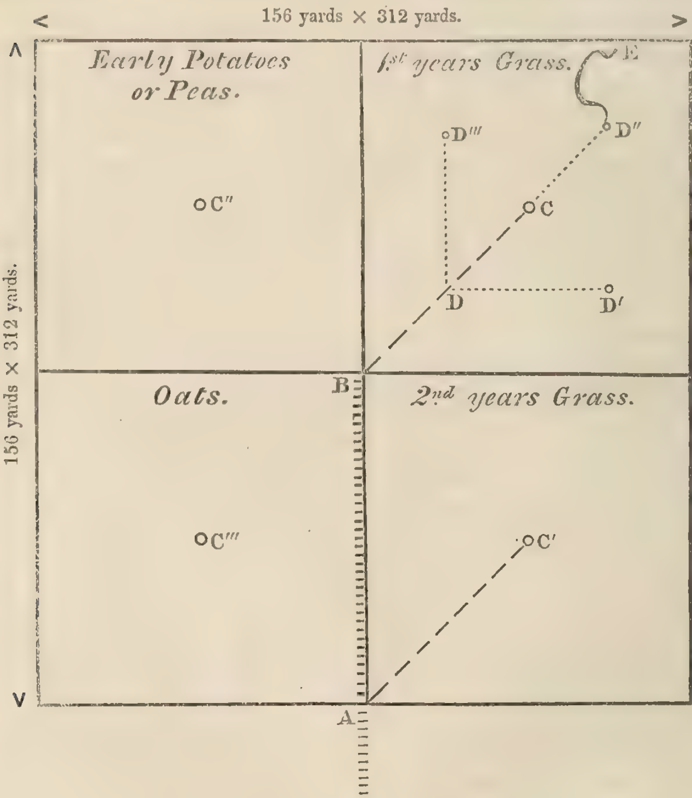
diate efficacy, which are due to the soluble state in which it holds the elements which form the structure of plants. Fibrous matter, or particles visible to the eye, and which may yet be held in suspension, must be decomposed before they can be absorbed by plants, as the most powerful microscope fails to detect the apertures to their spongioles. The conclusions of all horticulturists are in favour of frequent applications of manure in solution and very largely diluted; and on this practice depends the profit to be gained, by a speedy conversion of manure into food, and food into manure and money, so that the process may be repeated four or five times in the season, illustrating the commercial principle of quick returns. The cast-iron main leading from the pumps must be laid 20 inches underground, and terminate in the centre of the ground to be irrigated; the suction and main pipe to be 4 inches inside diameter, and, as a rule, the longer the suction-pipe the larger must be the diameter. This will be all the fixed piping I propose to have. I may remark that, in laying down pipes, every care should be taken to avoid right-angle turns or sharp bends; the disregard of this rule will involve a great loss of power. The bad effect of angles on pipes is clearly manifested in the experiments of Rennie, published in the Philosophical Transactions of the Royal Society. From a pipe 15 feet long, 1½ inch diameter, under a head of 4 feet, he had delivered during equal intervals of time—

	Cubic feet.
From the straight pipe	4196
From the pipe with fifteen semicircular bends ..	3694
" " one right angle	3334
" " with twenty-four right angles	1519

Another point worthy of attention is well stated in an able French treatise on hydraulics. "The pipes of which conduits are formed are generally more or less deformed; their section is not always circular, and the interior surface is often covered with superfluous ridges and asperities which retard the motion. Where there are joints, the direction of the axis of the whole conduit is not always an unbroken line; the interior surface is not cylindrical; the edges of some of the pipes advance inwards, and form projections; the fluid lines which arrive at the projecting parts are arrested, divided, and sometimes thrown back; hence disturbances in the motion, loss of motive force, and a sensible reduction in the discharge."

At that part of the main-pipe which coming from the homestall enters the square at A (if our area of 20 acres be represented by the sketch below), a branch with two arms will have to be brought to the surface of the land, and the same at the termination of the main-pipe at B. As only one of the two arms on each

branch will be in use in the same season, it will be necessary to plug up the other. To either of these arms on the surface, light cast-iron pipes, of 3-inch diameter, with turned and bored joints, are to be connected, long enough to form a line of such piping to the centre C (*see sketch*) of each of the 5 acres requiring to be irrigated through the season. It will be necessary to have a yard or



so of 3-inch gutta-percha tube connecting this line of pipes with the arm from the main-pipe, so as to compensate for any difference of inclination in the ground. These pipes, from the nature of the joints, can only form a straight level line, and therefore require to be propped up, or the ground to be somewhat levelled for their reception. The joints of these pipes should be rubbed over with tallow, or some such preparation, to prevent rust, and make them easily separate when required. One set of them is to be taken up at the end of the season and relaid in the spring on the next 5 acres, which come under irrigation in the rotation.

The 10 acres which it is proposed yearly to irrigate, being composed of 5 acres of year-old rye-grass, and 5 acres of two-year old, these surface-pipes remain for two seasons unmoved. On the line of pipe B C, there must be at point D a branch cast on the pipe, to allow the other pipes to be attached when necessary for irrigating that portion of land which is nearest to it.

That the liquid may be equally distributed over every portion of the square, other movable pipes will be required, which may be applied at D and C, so as to form three leads DD′, DD‴, CD″; these may be of galvanized sheet-iron of 20 gauge, and $2\frac{1}{2}$ inches inside diameter, in lengths of 15 feet. The joints are formed of a collar of vulcanized india-rubber, permanently bound round on the end of one pipe, and fixed to the other by a cramp-iron wedged up tight. A yard or two of gutta-percha should be used to ease off the bends at the different points of connection. A gutta-percha or other flexible pipe will be attached at D′ D″ D‴, commanding a range of $1\frac{1}{4}$ acres from each point. This pipe for convenience may be joined in the middle by a brass screw joint.

I have seen descriptions of distributing-machines recommended as economizers of labour, &c., but their advantages, if they possess any, are more than counterbalanced. The common form is an arrangement for winding the hose round a drum, and in this position the fluid is forced through and distributed from a nozzle having a small orifice, and throwing the liquid to various distances through the air. Such a machine, independent of its costliness, has the disadvantage of causing a considerable loss of force proportionate to the curvatures introduced. The amount of friction and resistance thus brought into action causes a diminished velocity in the fluid mass, which causes a reduction in the quantity discharged.

At the mouth of the gutta-percha pipe, a small piece of metal should be fixed at such an angle that the fluid, when forced against it, distributes itself in a fish-tail form on the land. I do not think it advisable to force the liquid through a small orifice in the shape of a jet, as this involves loss of power as well as of ammonia, and the person directing the pipe cannot insure such an even delivery over the surface as when it is only thrown to the distance of a few feet. To distribute evenly and well is a very nice operation, requiring care and attention. It seems of little importance at the time, that a few yards in one place should get twice or three times as much of dressing as another small plot, and at first all looks uniform and fair above; but as the crop proceeds, the difference is shown to a line, by the uneven growth which is exhibited. In considering the amount of piping,

it will be seen that the only fixed underground pipes required are from A to B; the total lengths will stand thus:—

		Yards.
A to B, 4 in. diameter cast-iron, say..		156
Pipes from pumps to ground, ditto, ditto		50
"	B to C / A to C } 3 in. diameter	220
"	D to D', $2\frac{1}{2}$ in. diameter galvanised iron ..	80
"	D' to E, $2\frac{1}{2}$ in. diameter gutta percha ..	50
		556

Tanks for holding the liquid manure should be provided before the winter season commences, so that all the manure may be scrupulously collected and saved. If the investment is made by the landlord, on which the tenant is to pay a percentage, circular tanks of brick set in cement, 12 to 14 feet deep, will be found economical and convenient. If the tenant makes the outlay himself on the strength of a long lease, a cheaper expedient might be resorted to. I made two cheap tanks, which answered the purpose well; they were faced with rough outside slabs of wood, supported by frames, and well packed behind with dry black loam. Their size will be determined by the number of cattle stall-fed through the winter, which in the instance before us we will assume to be 50 head; in fact, that number may be kept in the stall all the year round. The liquid will be stored from November to March, and the quantity obtained will be not far from 5 gallons per head per day, besides that which will be absorbed by litter. This calculation is made on the supposition that boards are adopted, or some such plan having the same end in view, so that the cattle will require but a small quantity of straw for bedding, say from 3 to 4 lbs. per head per day. It will be found that by the beginning of March 28,000 gallons of pure liquid manure will have been collected; and to contain the greater part of this a tank should be provided holding 25,000 gallons. Another similar tank will also be needed for mixing the water and manure, connected with the former at the bottom by a pipe, and provided with a valve for regulating the dilution. The contents of the tanks may therefore be 25,000 gallons each. The size of these tanks will be 21 feet diameter and 12 feet deep, inside measurement. A small well should be placed at the bottom of the mixing-tank to receive the suction-pipe, so that all the matter capable of being removed in suspension may be pumped out at each operation. The end of the pipe must be secured against the admission of substances likely to stick in the valves; and an easy mode of effecting this is by covering the well with a perforated board, or the end of the pipe with a gutta-percha bottle perforated.

Some have advocated the constant application of the manure to the soil at all seasons, thus making the land the storehouse for the fertilising matter. It is a question as yet undecided whether the same amount of liquid, applied as it is voided, through the winter season, will produce the same weight of vegetable matter as when stored in tanks for application during the growing season. Much would doubtless depend on the description of soil, its powers of retaining ammonia, and the amount of rainfall during the winter months.

I have stated that by March there will be 28,000 gallons of urine for immediate distribution, the specific gravity of which, if undiluted, will be from 1015 to 1018; this diluted with 84,000 gallons, or three times its weight, of water, will give 11,200 gallons for each of the 10 acres, which for an early dressing, in the season when the ground is tolerably moist, will be ample. Should dry weather set in after this, and the grass appear to be standing still, that portion of the field required for the earliest cutting may have a good dressing of water to hasten it forward. The quantity of liquid manure produced throughout the summer will be about 56,250 gallons, which, for an average of soils and seasons, may be diluted with nine times its bulk of water—thus affording, when added to the pure liquid, 56,250 gallons for each acre through the season, or four dressings of 14,000 gallons apiece after the removal of the first cutting. The quantity of water, therefore, needed for the mere dilution of the liquid manure will be 590,250 gallons, or 2635 tons. This can only be considered an approximation, as much depends on the temperature, moisture, and description of the soil.

After dressing with the diluted manure, at an interval of a few days (according to the weather), a dressing of plain water should be applied. To succeed in obtaining the quickest possible growth, the ground should never be allowed to become dry or parched; this must be prevented by as frequent waterings as are required to effect this object. When the grass is long enough to protect the surface, and afford shade from the heat of the sun and the wind, nothing more will be needed.

Other valuable additions may be made to the contents of the tanks, frequently at little expense, and which will greatly add to the fertility of the land. Dead animals, after a certain amount of dissection, will soon become liquefied, and in a fit state for conveyance through the pipes. The ammoniacal liquor from a neighbouring gas-work, if procured at a fair price, will be found a powerful fertilizer; its specific gravity, if good, will be 1025, and it will bear large dilution. Occasional applications of guano, sulphate of ammonia, and nitrate of soda, in quantities of from 1 to 3 cwts. per acre, sown broadcast, and immediately washed

into the soil, will be found useful in bringing up the land to a high state of fertility; and this should not be overlooked, especially where the land is at all below par.

It will be found then that, beyond the water wanted for the actual dilution and conveyance of the manure, a large additional supply can be used with the greatest advantage and profit. A good soaking of 1 inch in depth, equalling 22,000 gallons, or 100 tons per acre, after each dressing of diluted liquid, will amply repay the cost; and five such dressings on the acre would, for the 10 acres, raise a further demand for a million gallons, or over 5000 tons; and on many soils a larger quantity than this would greatly increase the results, the lighter land taking a more frequent and plentiful supply than the more compact and clayey soils.

The best mode of cropping the 20 acres intended to be irrigated will be by adopting a four-course system, thus—1st, early potatoes or peas; 2nd, Italian rye-grass; 3rd, Italian rye-grass; 4th, oats. At the commencement the land should be well cultivated and highly manured for potatoes, which will come off the land by the end of July; it is then to be well scarified and harrowed, so as to form a fine seed-bed: the grass-seed, at the rate of 3 bushels to the acre, is then sown, and covered in with a light seed-harrow, and afterwards rolled: if the land is not in high condition, 2 cwts. of guano will assist in bringing forward the plant, which will by this means be tolerably strong before winter. Early in spring it will receive a good dressing of liquid manure, and should be fit to cut from the middle of April to the middle of May, varying according to situation and climate. I was not able to adopt this system in Kincardineshire, as no green-crop that I could grow would come off the ground early enough to allow the grass-seed to be sown with a fair chance of standing the winter in that northern climate; but I know it is adopted with success even as far north as the neighbourhood of Edinburgh. I there followed a three-course system on my irrigated ground—viz., 1st, turnips or potatoes; 2nd, grass; 3rd, grass, a portion of which was at times allowed to seed. The grass was laid down in two sowings, during the spring, at an interval of three weeks or a month, with 3 bushels of grass-seed and 1½ bushels of oats per acre, all to be cut green. The addition of the oats greatly augmented the bulk of the first and second cuttings, and at the same time nursed up the young grass. In Scotland there was a risk in sowing down the Italian rye-grass with a grain-crop which was to be allowed to ripen, as in a rainy season the grass will grow as rank as the crop with which it is sown. Another disadvantage arises from the liability of the grain-crop to lodge, thus destroying large patches

of the grass. It might be worth while to lay down a few acres of permanent grass where an abundant supply of water can be cheaply obtained, using at the same time some of the concentrated manures. The grasses should be selected from those varieties which seem to thrive so well and attain such luxuriance in the Craigentinny meadows, near Edinburgh: I may mention the Meadow-foxtail, Cocksfoot, and Timothy, as being the most prominent.

The Earl of Essex, at Cassiobury, keeps pumps constantly at work forcing water from the river, by water-power, to a considerable height and distance, and occupying one man through the summer in distributing it by hose on the grass-land with the best possible effect. Slight top-dressings are here used when thought necessary. With pumps of the size before mentioned, about 1¼ acre can receive a dressing of nearly an inch in depth in the course of five hours with the aid of one man at the distributing-pipe.

I think it will be found that Italian rye-grass will yield a larger return under irrigation than any other crop. Mr. Dickinson (to whom we are all greatly indebted for having called public attention to his very successful cultivation of this grass), experimented, I believe, some years ago, on several different grasses, under similar treatment, and found that the Italian produced a greater quantity of vegetable food than any other. Analysis and experience have also proved it to be a very nutritive plant, capable of producing as much milk or beef as any other grass grown. One great inducement to apply the liquid to grass in preference to other crops is, that from no other plant can you get so quick or so many returns in the year; whilst the resulting consumption of such green-crops on the farm lays the foundation for future fertility. The 10 acres of irrigated grass will yield more food for summer soiling, and at a cheaper rate, than any other system of cultivation at present known; and the addition of a large manure-heap at the end of the summer, representing the heavy crops of grass consumed in the stall, will prove a valuable gift to the remainder of the farm.

Attention must be called to the fact, that each crop should not occupy the ground longer than its due portion of time. If the rate of consumption does not clear the land quick enough, the surplus should be cut, carried off the ground, and made into hay. I have found from experience that an ox will eat, in the house, 144 square yards of grass per week, the crop being a good average one, probably weighing over 12 tons: this was arrived at from a fortnight's observation of the quantity cut for some 20 head of two-year olds and a few barren cows. At this rate an acre will keep 33 head for one week. In the present

instance, the first three crops should be cut at the rate of from $1\frac{3}{4}$ to 2 acres per week, thus clearing the 10 acres in from five to six weeks: $1\frac{1}{2}$ acres will supply the green food required for the 50 head for one week, so that there should be from the first three cuttings about 90 tons of green grass, the produce of about 7 acres once cut, to make into hay: this will come in for use at the end of the season, and make up for any deficiency in the last two crops, if required.

It will be seen that the farm supplies the irrigated portion with the liquid manure furnished by the keep of 50 head of stock during 28 winter weeks, and gets in return the solid manure made during 24 weeks in the summer, from the consumption of some 500 tons of green grass.

That the irrigation system, combined with house-feeding, enriches the whole farm, there is, I think, little doubt; my own experience has satisfied me fully on that point; but as to how much of this increase of fertility is due to the balance of exchange being in favour of the farm, or to the fact that the manure from grass, as generally consumed on pasture, is almost valueless, is a question yet to be determined.

No time should be lost in applying the liquid after the grass has been removed, as by so doing you immediately prepare for the growth of another crop. It must be remembered that there are only a few months of growing weather, therefore a loss of two or three days after each cutting may make a difference, at the end of the season, of one crop. Every effort should be made to produce a heavy first cutting; success much depends on this: less space is then required to furnish the amount of grass necessary for the stock, and consequently there is less ground requiring irrigation after the grass is taken off. With diligence and skilful management five crops may be taken in the first season, and as many the second. After this the land is broken up, and a heavy crop of oats may then be expected.

The growth of a uniform supply of grass through the summer and autumn is invaluable; and towards the end of the season, when pastures are bare and food scarce, a plentiful supply is by this means insured, and the stock kept in a progressive state. The Italian rye-grass remains longer palatable as food than grass produced in the ordinary way, and may also be given fresh from the scythe without any after-inconvenience to the animal. The best time for cutting is just as the ear is shooting out; there is at that time a fair proportion of solid matter in the plant, and the ground is not robbed of its grain-producing elements. To allude briefly to my own experience, I may state that, although labouring under disadvantages as to climate, I succeeded in raising very heavy grass-crops. In the summer of 1858 I took

the following cuttings, which, in the aggregate, measured 12 feet in height, viz.:—

		ft.	in.
1st cutting,	22nd May	2	6 high
2nd ,,	28th June	3	0 ,,
3rd ,,	10th August	3	6 ,,
4th ,,	17th September	2	0 ,,
5th ,,	13th November	1	0 ,,

These crops were all consumed in the house; and although there were but $3\frac{1}{4}$ acres irrigated with liquid manure, for stall-feeding through the summer, they maintained, with the aid of 8 acres of water-meadow, 20 cows, 4 feeding cattle, 1 bull, 8 calves, the partial keep of 5 cart-horses, and the total keep of a pony. The 8 acres of water-meadow are not to be considered as representing the degree of fertility which the term of "water-meadow" suggests to a Hampshire or a Devonshire man; I only obtained a very partial use of the water—seldom using it but at night, and on Sunday when the mills were not requiring it. I kept the returns of my live-stock, while feeding on grass, separate from the produce of the winter green-crops, so that the one was quite independent of the other; but of the 20 cows, I think about five were dry, on the average, through the grass season. The following is the account in detail:—

	£	s.	d.	£	s.	d.
Cr.						
1 bull keep through summer				3	0	0
4 cattle feeding				16	0	0
8 calves, value of food				14	0	0
Butter and cheese				94	9	0
5 cart-horses (partial keep)				4	0	0
1 pony				4	0	0
				135	9	0
Dr.						
8 acres water-meadow at 6*l.*	48	0	0			
$\frac{3}{4}$ acre rape	6	0	0			
1 acre cabbage-leaves	2	0	0			
				56	0	0
				79	9	0

This account represents, as fairly as I can state it, the money-return from $3\frac{1}{4}$ acres, which equals 24*l.* an acre. This same land yielded $2\frac{1}{2}$ qrs. of oats per acre the year I took the farm, and was in every way completely run out. The cows giving milk were out on the meadow for about three hours daily, where they had both food and exercise. I never had any disease among my cattle, which I attribute in a great measure to good ventilation. The Italian rye-grass and house-feeding seemed to agree well with the cows, as their skin testified. I found dairy-farming and the

rearing of young stock the most profitable mode of converting the grass into money. After stock-feeding for the first three years, I therefore turned my attention principally to the dairy, and the change worked an improvement on the balance-sheet. For some time past my milk was sent daily 24 miles by rail, and the butter went once a week a distance of 60 miles.

It will be seen from this that a very large number of stock can be kept upon a few acres of Italian rye-grass cultivated in this manner, and the land will be found to increase in fertility: you may almost insure a rapid succession of growth when placed under favourable conditions as to liquid manure and water. If more grass is raised than is required for feeding, it may be left for seed, and will in this way yield a large return. I have harvested as many as 79 bushels per acre in one crop; this was from the second year's growth.

We now come to the cost of pumps, pipeage, and tanks, which depends on the price of iron at the time, the locality, and the market from which the remaining apparatus is purchased—circumstances which will make the experience of one man differ largely from that of another. I will, however, endeavour to take a fair estimate of expenses for laying down the quantity of land before mentioned at a rate at which it can be executed in many districts. The excavation of the tanks will cost from 4*d.* to 6*d.* per cubic yard, and there will be 208 cubic yards in each tank; the walls to be of brick, $4\frac{1}{2}$ inches thick, laid in cement: they will cost from 18*l.* to 25*l.* each. The price of iron pipes is now 5*l.* 5*s.* per ton. There is supposed to be a stationary engine on the farm (but better still if there is a water-wheel). The irrigation-works will employ 4-horse power for 50 days in the season, and, therefore, must be charged with one-sixth of the first cost of the engine; the power required in most cases being small, unless the fluid be forced to a great height, will not make a great demand on the coals. The expenses of carrying out the system will stand thus:—

	£	s.	d.
Engine $\frac{1}{6}$ of first cost	25	0	0
Circular brick tanks	50	0	0
Pumps and fitting	45	0	0
Metal pipes, 4 in., 206 yds. at 2*s.* 6*d.*	25	15	0
Drains, lead, laying, hemp, &c.	3	5	0
Surface metal pipes, 3 in., 220 yds. at 1*s.* 9*d.* ..	19	5	0
Galvanized pipes, $2\frac{1}{2}$ in., 80 yds. at 1*s.* 2*d.*	4	14	0
Metal branches, collars, cramp iron, &c.	4	10	0
Gutta-percha pipe, $2\frac{1}{2}$ in., 50 yds. at 7*s.*..	17	10	0
,, ,, 3 in., 4 yds. at 9*s.*	1	16	0
Cocks, plugs, brass joints, and spreader	8	0	0
Contingencies	10	0	0
	214	15	0

The annual working-charges have next to be calculated, and these will vary widely with different men. Some there are who fail to perceive anything wrong until matters arrive at a climax; while others, more observant, and possessing mechanical taste, at once, at the very commencement, detect the least thing out of order. The ear of the latter at once discovers anything amiss—a loose bolt or a heated bearing, for instance; while the attention of the former is not aroused until some wheel or other has perhaps been deprived of sundry teeth, or the whole machinery is reduced to utter confusion: so much depends on care and management. The subjoined may be considered a fair estimate:—

	£.	s.	d.
Interest and depreciation at 7½ per cent. on 214*l*. 15*s*. 6*d*.	16	1	9
Coals, 10 tons at 15*s*..	7	10	0
Wages, half engineman's time at 3*s*. on 50 days	3	15	0
Labour, ditto at 2*s*.	5	0	0
Repairs	5	0	0
	37	6	9

N.B. Half the engineman's time is charged only, as it is presumed he will be partly occupied on smith or wright's work while the engine is going.

This amount, divided by the 10 acres in constant use, gives a yearly charge of 3*l*. 14*s*. 7*d*. per acre; and for this sum a constant growth of grass is secured through the summer; each acre receives ten or twelve dressings of water and of manure, consisting in the aggregate of from 800 to 1000 tons, and yielding in return a fourfold produce; while the fixed expenses, such as rent and taxes, ploughing and seed, remain the same as under the pasturing system. A centrifugal pump and gearing to throw the same quantity of liquid would cost about 25*l*. Tanks might also be roughly constructed by a tenant, as before mentioned, for about half the sum charged, the soil excavated often being worth, as a

* In this amount is included payment for the use of a steam-engine working at 4-horse power for 50 days.

The 150*l*. which is allowed for the cost of the engine will not supply a locomotive such as will be most generally available for farm purposes. Irrigation is only charged with one-sixth of this cost, or 25*l*., on the supposition, rarely if ever realised, that a farm-engine works 300 days in a year.

On this 25*l*. 7½ per cent. is allowed for interest and depreciation, and about 2½ per cent. (5*l*. on 214*l*.) for repairs, and thus we arrive at a conclusion which assigns 2*l*. 10*s*., or 1*s*. per day, as payment for the use of a steam-engine. If four or five times this sum be allowed, the merits of this question will not be materially affected, and such instances of low estimates seem to be the rule rather than the exception in our practice.

Most English farmers will consider that the cost of boarded floors ought to be added to this estimate, for most exceptional must be the want of straw which would lead them to provide these for their stock except with some ulterior view to the use of liquid manure.—P. H. F.

top-dressing, the cost of taking out. The difference of cost on these two points would reduce the estimate by 45*l.* The cost of my own machinery for irrigation was as follows:—

	£.	s.	d.
Tanks	25	0	0
Metal pipes, lead and laying	86	10	0
Cutting drains	2	0	0
Hydrants and brass joints	6	8	0
Manure pumps and fitting	30	10	0
Water pump	12	0	0
Shafting for ditto	8	0	0
Gutta-percha pipe, 90 yds.	19	10	0
	189	18	0

This was the expense on 20 acres, but only 12 acres were yearly under the system; this made the interest and depreciation account 1*l.* 4*s.* per acre of yearly charge.

My pumps and metal pipes have never cost anything for repairs during the seven years I have worked them. The gutta-percha pipe has required some patching, and, with the exception of the outer length, will last for another twelve years, as far as present appearances go. I cannot conclude without saying, that I found the money expended in irrigation works to be a capital investment; and I think that, under fair ordinary circumstances, others adopting the system will meet with the same result.

17, *Parliament-street, Westminster.*

II.—*Experiments with different Top-Dressings upon Wheat.* By Dr. Augustus Voelcker.

In 1859 I tried some experiments with top-dressings upon wheat, and published an account of them in Vol. XX., Part II., of this Journal. Several of the experiments were attended with results highly satisfactory in an economical point of view, at a time when the average price of wheat was only 42*s.* per quarter.

It seemed to me desirable to continue similar experiments upon the wheat-crop, and I have now the pleasure of laying before the members of the Royal Agricultural Society a short report of wheat experiments made in 1860, and again in 1861.

Wheat Experiments made in 1860.

The season of 1860 was not very favourable for wheat, and the general yield was below average. It therefore affords me pleasure to report that in 1860 the wheat-crop on our farm on the whole

was a fair average crop, but my experiments, as in 1859, were particularly successful.

The land on which the wheat was grown is considered decidedly better than that on which my experiments were tried in 1859. The soil was in a fine state of preparation on the surface, and extended to a depth of 9 or 10 inches.

The subsoil of most of the fields on our farm is a stiff clay; but in the case before us it is porous limestone-rubble, mixed with clay, itself resting on oolitic limestone-rock.

The land is well drained, and the field considered a good one for wheat, which has never been known to have been blighted on this spot, but has yielded well when in other fields it was deficient or attacked by disease.

A large quantity of the soil from the experimental field (field Nos. 3 and 5 on the map of the Royal Agricultural College Farm) was turned over and well mixed, so as to obtain a fair average sample for an analysis, which gave the following results:—

Composition of Soil in Field No. 3 and 5, Royal Agricultural College Farm.

		Calculated Dry.
Moisture	17·50	..
Organic matter and water of combination	6·66	8·07
Oxides of iron and alumina	16·07	19·48
Carbonate of lime	12·88	15·61
Sulphate of lime	·22	·27
Magnesia	·57	·69
Phosphoric acid	·05	·06
Potash	·52	·63
Soda	·39	·48
Insoluble siliceous matter (chiefly clay)	45·14	54·71
	100·00	100·00

This soil scarcely contains any siliceous sand separable by washing, and consists principally of clay, mixed with a fair proportion of carbonate of lime. It may be described as a good friable, calcareous clay-loam.

The whole field is tolerably level. The part reserved for the experiments was perfectly so, and the soil, as far as could be judged, of uniform depth. Its extent is $29\frac{1}{2}$ acres, and the preceding crop was beans.

Two acres covered with a very equal plant were measured out, and carefully divided into 8 equal plots of $\frac{1}{4}$ acre each. They were surrounded on all sides by a considerable breadth of the general wheat-crop. These 8 plots, with the exception of plot No. 6, which was left unmanured, were top-dressed on the 27th of March, as follows:—

Plot.	Top-dressing.	Rate of Dressing per Acre.	Cost per Acre.
		cwts.	£. s. d.
I.	1 cwt. of a compound wheat-manure	4	1 12 6
II.	70 lbs. of Peruvian guano	2½	1 12 0
III.	42 lbs. of nitrate of soda	1½	1 10 0
IV.	42 lbs. of nitrate of soda .. .. And 84 lbs. of common salt	1½ 3	1 13 0
V.	84 lbs. of common salt	3	0 3 0
VI.	Unmanured	..	..
VII.	56 lbs. of sulphate of ammonia	2	1 16 0
		bushels.	
VIII.	8 bushels of soot	32	0 16 0

The manures were all passed through a fine sieve, and, with the exception of the soot, mixed with fine coal-ashes, and then sown evenly over the different plots by Reeves' broad-cast manure distributor. This machine is a capital implement for sowing dry top-dressings. It is most essential that the mixtures should be quite dry, for if in the least damp they do not fall regularly upon the land, and the machine is apt to become clogged up. This is especially the case with substances which, like common salt, always feel more or less damp. Unless these are purposely dried, or mixed with dry, fine sand, we find they cannot be readily and evenly sown by this machine.

Plot I.—Top-dressed March 27 with compound wheat-manure, produced :—

	cwt.	qrs.	lbs.
Corn, Head	5	1	17
" Tail	0	0	15
	5	2	4
Straw	7	2	26
Cavings	0	0	27
Chaff	0	1	15

Produce per Acre :—
Corn (head and tail) 42 bushels 2 lbs.
Straw (including cavings and chaff) 1 ton 13 cwt. 1 qr. 20 lbs.
(Weight of bushel, 59 lbs.)

This wheat looked very healthy throughout the summer, but did not yield so well as Nos. 2 and 5. The effects of the top-dressing upon the young wheat were visible a week after its application.

The wheat-manure analysis was found to contain in 100 parts :—

Moisture	12·36
*Organic matter, ammoniacal salts, and water of combination	22·35
Bi-phosphate of lime	2·91
Equal to bone-earth rendered soluble	(4·54)
Insoluble phosphates (bone-earth)	6·97
Sulphate of lime (anhydrous)	20·89
Sulphate of magnesia	1·26
Chloride of sodium (common salt)	24·70
Nitrate of soda	4·63
Insoluble siliceous matter (sand)	3·93
	100·00
*Containing nitrogen	3·38
Equal to ammonia	4·10

PLOT II.—Top-dressed with Peruvian guano, produced :—

	cwt.	qrs.	lbs.
Corn, Head	5	3	23
„ Tail	0	0	13
	6	0	8
Straw	8	1	6
Cavings	0	1	5
Chaff	0	1	20

Produce per acre :—

Corn (head and tail) 46 bushels 6 lbs.

Straw (including cavings and chaff) 1 ton 16 cwt. 12 lbs.

The guano used in this experiment was genuine Peruvian of superior quality, as will be seen by the following analysis :—

Moisture	17·03
*Organic matter and ammoniacal salts	52·04
Phosphates of lime and magnesia	19·61
Alkaline salts	10·55
Containing phosphoric acid	(1·22)
Sand	·89
	100·12
*Containing nitrogen	14·94
Equal to ammonia	18·14

PLOT III.—Top-dressed with nitrate of soda, produced :—

	cwt.	qrs.	lbs.
Corn, Head	5	3	23
„ Tail	0	0	13
	6	0	8
Straw	9	0	1
Cavings	0	0	21
Chaff	0	1	3

Produce per acre :—

Corn (head and tail) 44 bushels 10 lbs.

Straw (including cavings and chaff) 1 ton 17 cwt. 3 qrs. 16 lbs.

A few days after the application of the nitrate of soda the plant assumed a more intensely green colour, and for a long time afterwards the effects of the nitrate were plainly shown by this colour

and the thriving condition of the wheat. The nitrate of soda employed in this experiment was a good sample, as will be seen by the following analysis :—

Composition of Nitrate of Soda.

Moisture	2·09
Chloride of sodium	1·07
*Pure nitrate of soda	96·65
Sand	·19
	100·00

Plot IV.—Top-dressed with nitrate of soda and salt, produced :—

	cwt.	qrs.	lbs.
Corn, Head	6	0	16
„ Tail	0	0	13
	6	1	1
Straw	9	1	19
Cavings	0	1	0
Chaff	0	1	8

Produce per acre :—
Corn (head and tail) 47 bushels 31 lbs.
Straw (including cavings and chaff) 1 ton 19 cwt. 3 qrs. 24 lbs.

This wheat looked remarkably healthy and succulent, and, like the preceding three plots, of decidedly darker green than that on other plots.

Plot V.—Top-dressed with salt, produced :—

	cwt.	qrs.	lbs.
Corn, Head	4	2	7
„ Tail	0	0	9
	4	2	16
Straw	5	2	1
Cavings	0	0	21
Chaff	0	1	2

Produce per acre :—
Corn (head and tail) 35 bushels 15 lbs.
Straw (including cavings and chaff) 1 ton 3 cwt. 3 qrs. 16 lbs.

In comparison with the four preceding plots the wheat on Plot V., though healthy-looking, was backward and shorter in the straw at harvest-time.

Plot VI.—Left unmanured, produced :—

	cwt.	qrs.	lbs.
Corn, Head	4	1	10
„ Tail	0	0	15
	4	1	25
Straw	6	0	0
Cavings	0	0	14
Chaff	0	0	19

Produce per acre :—
Corn (head and tail) 33 bushels 57 lbs.
Straw (including cavings and chaff) 1 ton 7 cwt. 20 lbs.

There was not much difference between the appearance of this crop and that on Plot V. At an early stage of growth the crops on Plots I., V., and VI. had a less dark green colour in comparison with the others, and especially with those that were top-dressed with nitrate of soda. The wheat stood perfectly erect at harvest-time.

Plot VII.—Top-dressed March 27 with sulphate of ammonia, produced:—

	cwt.	qrs.	lbs.
Corn, Head	5	2	22
„ Tail	0	0	11
	5	3	5
Straw	9	0	9
Cavings	0	0	20
Chaff	0	1	1

Produce per acre:—
Corn (head and tail) 44 bushels.
Straw (including cavings and chaff) 1 ton 18 cwt. 8 lbs.

The sulphate of ammonia was the ordinary commercial article, and on analysis was found to contain:—

Moisture	6·59
*Pure sulphate of ammonia	91·94
Mineral impurities	1·47
	100·00
*Containing ammonia	23·68

Plot VIII.—Top-dressed with soot, produced:—

	cwt.	qrs.	lbs.
Corn, Head	5	1	19
„ Tail	0	0	8
	5	1	27
Straw	7	3	25
Cavings	0	0	24
Chaff	0	1	6

Produce per acre:—
Corn (head and tail) 41 bushels 41 lbs.
Straw (including cavings and chaff) 1 ton 13 cwt. 3 qrs. 24 lbs.

The young wheat on this and on the preceding plot was not quite so dark-coloured as on Plots III. and IV., and not quite so strong as that dressed with Peruvian guano. No perceptible difference was visible on Plots VII. and VIII.

An analysis of the soot furnished the following results:—

Composition of Commercial Soot.

Moisture	7·39
*Organic matter	43·09
†Sulphate of ammonia	12·72
Insoluble siliceous matter	15·12
Oxide of iron and alumina	6·51
Carbonate of lime	10·63
Carbonate of magnesia	1·84
Alkaline salts (by difference)	2·70
	100·00
*Containing nitrogen	·21
Equal to ammonia	·25
†Containing ammonia	3·29

The wheat was reaped towards the end of August, and threshed out on the 27th of September, 1860.

There was no appreciable difference in the weight of the corn grown on these 8 plots. On an average an imperial bushel weighed 59 lbs. The produce per acre, therefore, was uniformly calculated at 59 lbs. per bushel.

A glance at Tables I. and II. (page 23) will show several particulars to which attention may be directed.

1. The yield of the unmanured portion of this field was 34 bushels of corn and 1 ton 7 cwt. of straw per acre, which is a tolerably good crop for a bad wheat-season.

In 1859—a better season than 1860—the unmanured portion of the experimental field yielded only 27 bushels of corn and 17 cwt. 3 qrs. of straw, in round numbers. Notwithstanding the larger natural produce, due no doubt to the superior character of the land on which the experiments were tried in 1860, several of the top-dressings gave a very considerable increase both in grain and straw. We have thus here a partial proof that nitrogenized top-dressings are not merely beneficial to wheat when grown on poor land or soils out of condition, but that they may be likewise applied with advantage to good wheat-land.

2. In 1859, the heaviest crop was produced by 6 cwt. of Proctor's wheat-manure; in 1860, by 1½ cwt. of nitrate of soda and 3 cwt. of salt.

This dressing, it will be seen, gave no less than 47½ bushels of grain and nearly 2 tons of straw per acre; or an increase of 13 bushels of corn and 12¾ cwt. of straw over the unmanured plot.

On soils in good condition, a top-dressing with 1½ cwt. of nitrate of soda and 3 cwt. of salt, applied towards the end of March or the beginning of April, is one of the best manuring mixtures that can be employed.

TABLE I.—*Showing the Produce, in lbs. and bushels,* of Corn on Experimental Plots, calculated per Acre, and the Increase per Acre over Unmanured Plot. (Weight per bushel, 59 lbs.)*

Plot.	Manure employed per Acre.	Produce in Corn per Acre.		Increase of Corn per Acre.	
		lbs.	bushels.	lbs.	bushels.
I.	4 cwt. of wheat-manure	2480	42	476	8
II.	2½ cwt. of Peruvian guano ..	2720	$46\frac{1}{10}$	716	$12\frac{1}{10}$
III.	1½ cwt. of nitrate of soda	2606	$44\frac{1}{6}$	602	$10\frac{1}{6}$
IV.	1½ cwt. of nitrate of soda and 3 cwt. of salt	2804	$47\frac{1}{2}$	800	$13\frac{1}{2}$
V.	3 cwt. of salt..	2080	$35\frac{1}{4}$	76	$1\frac{1}{4}$
VI.	Unmanured	2004	34	..	..
VII.	2 cwt. of sulphate of ammonia ..	2596	44	592	10
VIII.	32 bushels of soot	2460	$41\frac{2}{3}$	456	$7\frac{2}{3}$

* In calculating the produce in bushels, the odd pounds have been omitted for convenience' sake.

TABLE II.—*Showing the Produce in Straw per Acre, and Increase over Unmanured Plot.*

Plot.	Manure per Acre.	Produce in Straw per Acre.				Increase in Straw per Acre.		
		tons	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.
I.	4 cwt. of wheat-manure	1	13	1	20	6	1	0
II.	2½ cwt. of Peruvian guano	1	16	0	12	8	0	20
III.	1½ cwt. of nitrate of soda	1	17	3	16	10	2	24
IV.	3 cwt. of salt and 1½ cwt. of nitrate of soda	1	19	3	24	12	3	4
							loss	
V.	3 cwt. of salt	1	3	3	16	3	1	4
VI.	Unmanured	1	7	0	20		..	
VII.	2 cwt. of sulphate of ammonia	1	18	0	8	10	3	16
VIII.	32 bushels of soot	1	13	3	24	6	3	4

3. The special wheat-manure, which has a similar composition to that used in 1859, did not give as favourable a result as nitrate of soda and salt, nitrate of soda alone, sulphate of ammonia and guano. This result seems to prove that whilst on good land purely ammoniacal or nitrogenized manures may be most economically employed as top-dressings for wheat, on naturally poor soils mixed mineral and nitrogenized manures are the most desirable.

On such soils, especially when deficient in available phosphates, a manure, containing phosphatic constituents as well as nitrates and ammoniacal salts, applied at the rate of 4 or 5 cwt. per acre, is likely to produce a heavier crop, and leave the land in a better condition, than nitrate of soda and salt.

4. Nitrate of soda alone gave not nearly so good a result as the same quantity of nitrate mixed with twice its weight of salt.

This agrees perfectly with my experience of 1859; it should

therefore be an invariable rule to mix nitrate of soda with salt, when it is to be used as a top-dressing for wheat.

5. Salt alone, practically speaking, hardly produced any increase in the yield of grain, and slightly diminished the produce in straw.

Salt, applied in any quantity to cereal crops and to grass-land, certainly does not increase the produce. By checking over-luxuriance it, to a certain extent, prevents the growth of rank grasses, and produces a finer herbage; and in the case of cereal crops keeps the straw shorter, and thereby prevents their getting laid at harvest-time.

6. Peruvian guano stands second on the list in point of efficiency. It gave, indeed, a very good result, having produced an increase of $12\frac{1}{10}$ bushels of corn and 8 cwt. of straw, at a cost of 1*l.* 12*s.* 6*d.*

7. Ammoniacal salts and nitrate of soda appeared to increase very considerably the produce in straw. Top-dressings, consisting chiefly of ammoniacal compounds or nitrates, should therefore be used in moderate quantities. If large quantities are put on the land, the sample of wheat is injured and the crop likely to fall down, especially in wet seasons.

8. Where soot can be purchased at from 6*d.* to 8*d.* per bushel it may be used with advantage, at the rate of 30 to 40 bushels per acre, as a top-dressing for wheat, when a larger outlay of money cannot be commanded.

To enable the reader to catch at a glance the relative advantages and the clear profit which was realized by each of these top-dressings, I have constructed the following table. The wheat is valued at 64*s.* per quarter, the average price in the market at the time when it was threshed, and the straw at 30*s.* per ton, as a usual selling price:—

TABLE *showing the Money Value of the Increase in Corn and Straw per Acre over the Unmanured Plot in Experimental Field, and the Clear Profit after deducting the price paid for Manures.*

Plot.		Money Increase in						Cost of Top-dressings.			Clear Profit.		
		Corn.			Straw.								
		£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
I.	4 cwt. of wheat-manure	3	4	0	0	9	4½	1	12	0	2	1	4½
II.	2½ cwt. of Peruvian guano	4	16	9½	0	12	3½	1	12	6	3	16	7
III.	1½ cwt. of nitrate of soda	4	1	4	0	16	1	1	10	0	3	7	5
IV.	3 cwt. of salt and 1½ cwt. of nitrate of soda ..	5	8	0	0	19	2	1	13	0	4	14	2
					loss								
V.	3 cwt. of salt	0	10	0	0	4	11	0	3	0	0	2	1
VI.	Unmanured		..			..			..			..	
VII.	2 cwt. of sulphate of ammonia	4	0	0	0	16	4	1	16	0	3	0	4
VIII.	32 bushels of soot	3	1	4	0	10	2	0	16	0	2	15	6

We thus see:—

1. That $1\frac{1}{2}$ cwt. of nitrate of soda and 3 cwt. of salt gave by far the most profitable return of all the top-dressings.

2. That guano gave a better return than sulphate of ammonia.

3. That there was hardly any economical advantage in applying salt alone as a top-dressing.

4. That although the outlay for soot amounted to only 16*s.* per acre, it gave a less profitable return than the most expensive top-dressing in the list.

Wheat Experiments made in 1861.

In the experiments which I tried in 1861, the same top-dressings as in 1860 were employed, with the exception of soot, which was replaced by a manure called ulmate of ammonia.

Having given before the composition of the other top-dressings, that of ulmate of ammonia alone requires to be here inserted. A fair average sample produced the following results:—

Composition of Ulmate of Ammonia.

Moisture	11·59
*Organic matter and ammoniacal salts	75·94
Oxides of iron, alumina, and traces of potash	2·52
Carbonate of lime	2·22
Alkalies, magnesia, &c.	1·26
Sand	6·47
	100·00
*Containing nitrogen	11·93
Equal to ammonia	14·49

On further examination I found that this manure contains only 2·05 per cent. of ammonia, in the shape of ammoniacal salts. It therefore hardly deserves the name of ulmate of ammonia,—a name which implies that most of the nitrogen present exists in the shape of ready-formed ammonia, which is not the case; the nitrogen, of which there is a considerable quantity, occurs in the shape of organic matter. The manure is, in fact, composed almost entirely of nitrogenized organic matters, such as wool and hair, which have been subjected to a peculiar process of preparation, that renders them much more soluble, and thus more easily available for the use of plants than such refuse is in its usual condition. Shoddy and wool-refuse are far too insoluble to be useful as a top-dressing for wheat. But as wool-refuse contains a great deal of nitrogen, I was anxious to experiment with this preparation, which is called in commerce ulmate of ammonia.

The field on which the experiments were tried had a second year's crop of seeds in 1859, which was fed off by sheep. The land was clean and well cultivated. A portion of the soil was submitted to a mechanical and to a chemical analysis; it yielded the following results:—

Composition of Soil in the Experimental Wheat-Field; Field No. 19 of the Royal Agricultural College Farm, Cirencester.

a. *Mechanical Analysis.*

Moisture	1·51
Organic matter and water of combination ..	11·08
Lime	10·82
Fine clay	52·06
Coarse clay and a little sand	24·53
	100·00

Like most land in the neighbourhood of Cirencester, this soil contains very little sand that can be separated by washing.

b. *Chemical Analysis.*

Moisture	1·51
Organic matter and water of combination ..	11·08
Oxides of iron and alumina	14·25
Carbonate of lime	10·82
Sulphate of lime	·71
Magnesia	·51
Potash (sol. in acid solution)	·32
Soda (sol. in acid solution)	·05
Phosphoric acid	·10
Insoluble siliceous matter (chiefly clay)	61·78
	101·13

This soil resembles much in composition that on which the experiments were made in 1860: both are calcareous clay-loams. There is, however, some difference between them. Field No. 19 contains rather more clay, and rests on a less porous subsoil than field Nos. 3 and 5, on which the experiments were made in 1860. On the whole No. 19 is inferior to Nos. 3 and 5, and probably not so uniform in its depth and general character as the latter. The whole of this field was in wheat. Two acres of the most uniform portion of the land were carefully divided into 8 equal plots, measuring exactly ¼ acre.

These plots were manured as follows:—

Experiments, 1861.

Plot.	Manure applied.	Rate of Dressing per Acre.	Cost of Manure per Acre.		
		cwt.	£.	s.	d.
I.	Peruvian guano	2½	1	12	6
II.	Wheat-manure (the same as in 1860) ..	4	1	12	0
III.	Nitrate of soda	1½	1	2	6
IV.	Unmanured	..		..	
V.	{Nitrate of soda	1½	1	5	6
	{Common salt	3			
VI.	Common salt	3	0	3	0
VII.	Sulphate of ammonia	2	1	12	0
VIII.	Ulmate of ammonia	6	2	5	0

Last season we purchased a first-rate sample of nitrate of soda, containing in round numbers 97 per cent. of pure nitrate, at 15*l.* 10*s.* per ton, and sulphate of ammonia at 16*l.* per ton. Both these manures, therefore, were a good deal cheaper than in 1860. The price of the guano was 13*l.* a ton.

All the manures were finely sifted and mixed with coal-ashes, and sown on the 5th of April with Reeves' broad-cast distributor.

The effects of the top-dressing were most visible on the 2 plots to which nitrate of soda was applied, on which the usual dark-green colour made its appearance in a few days, and could be observed for a long time afterwards.

The effects of the sulphate of ammonia and the guano were not quite so soon exhibited, as was also the case with the special wheat-manure.

For a long time no visible effects were produced by the ulmate of ammonia manure, but subsequently the wheat on Plot VIII. improved, and looked decidedly better than on the unmanured part of the field, though it never acquired such a deep green colour as that grown on the plots top-dressed with nitrate of soda and the ammoniacal manures.

The crop was carefully reaped, and after threshing the corn and straw, cavings and chaff were accurately weighed, and gave the following results:—

TABLE I.—1861.

Showing the Produce in lbs. and bushels of Wheat of the Experimental Plots, calculated per Acre.

(*Average weight per bushel*, 62 *lbs.*)

Plot.		Head.	Tail.	Total in Bushels of 62 lbs. each.	
		lbs.	lbs.	bush.	lbs.
I.	2½ cwt. of Peruvian guano	2476	40	40	36
II.	4 cwt. of wheat-manure	2512	16	40	44
III.	1½ cwt. of nitrate of soda	2776	26	45	12
IV.	Unmanured	1896	28	31	2
V.	1½ cwt. of nitrate of soda and 3 cwt. of salt	2784	32	45	26
VI.	3 cwt. of salt	2336	10	37	52
VII.	2 cwt. of sulphate of ammonia	2708	46	44	26
VIII.	6 cwt. of ulmate of ammonia	2392	36	39	10

There was no appreciable difference in the weight of the wheat from the different plots. On an average it weighed 3 lbs. more per bushel than the wheat grown in the preceding year.

TABLE II.—1861.

Showing the Produce in Straw, Cavings, and Chaff, of Experimental Plots, calculated per Acre.

Plot		Straw.				Cavings.			Chaff.			Total.			
		tons	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	tons	cwt.	qrs.	lbs.
I.	2½ cwt. of Peruvian guano	1	1	1	24	1	1	0	2	2	22	1	5	1	18
II.	4 cwt. of wheat-manure	1	0	0	4	1	1	0	2	3	0	1	3	0	4
III.	1½ cwt. of nitrate of soda	1	4	2	0	1	2	8	3	1	16	1	9	1	24
IV.	Unmanured	0	16	0	20	1	2	16	3	1	10	1	1	0	18
V.	1½ cwt. of nitrate of soda and 3 cwt. of salt	1	3	0	12	1	3	20	4	0	6	1	9	0	10
VI.	3 cwt. of salt ..	0	18	0	20	1	0	20	3	0	0	1	2	1	12
VII.	2 cwt. of sulphate of ammonia	1	2	2	20	1	1	24	3	2	16	1	7	3	4
VIII.	6 cwt. of ulmate of ammonia	1	4	1	8	1	1	8	3	0	8	1	8	2	24

For the sake of better comparison, the increase per acre in corn and straw over the unmanured portion of the experimental field is stated in the next table:—

TABLE *showing the Increased Produce per Acre in Corn and Straw (including Cavings and Chaff) over the Unmanured Plot IV., in lbs. and bushels.*

Plot.		Increase in Corn per Acre.			Increase in Straw per Acre.			
		lbs.	bush.	lbs.	tons	cwt.	qrs.	lbs.
I.	2½ cwt. of Peruvian guano	592	9	34	0	4	1	0
II.	4 cwt. of wheat-manure	604	9	42	0	1	3	14
III.	1½ cwt. of nitrate of soda	878	14	10	0	8	1	6
V.	1½ cwt. of nitrate of soda and 3 cwt. of salt	892	14	24	0	7	3	20
VI.	3 cwt. of salt	422	6	50	0	1	0	22
VII.	2 cwt. of sulphate of ammonia ..	830	13	24	0	6	2	14
VIII.	6 cwt. of ulmate of ammonia.. ..	504	8	8	0	7	2	6
IV.	Total produce of unmanured plot	1924	31	2	1	1	0	18

It will be seen that all the top-dressings produced a considerable increase in corn. Nitrate of soda and salt, as in former years, gave the best return, though almost identical with that obtained from nitrate of soda alone. Previously, both in 1859 and 1860, the addition of common salt to nitrate of soda had an excellent effect upon the crop. The apparent inefficiency of this admixture in 1861 is the more surprising, as salt alone then produced an increase of nearly 7 bushels of corn.

There are here several other anomalies against which we must

not shut our eyes, for a faithfully-recorded field-experiment, though it may not fully decide the question for which it was instituted, nevertheless is frequently useful in other respects, and at all events never mischievous in its practical bearing, like experiments which have been cooked so as to suit certain purposes, or to support a favourite theory.

Amongst the anomalous results in the preceding table may be noticed the large increase in corn and straw obtained by sulphate of ammonia. This increase is very much larger than that which was realized by its use in the preceding year, and likewise much larger than the increase obtained by Peruvian guano. Indeed the less favourable result which Peruvian guano appears to have produced in comparison with its effects upon the experimental wheat-crop in the preceding year, is one of the most remarkable of these anomalies.

It is difficult, if not impossible, to recognise a reason why in one year guano should give a much more favourable result than sulphate of ammonia, and in the next the latter should beat the former by several bushels. We cannot attribute this variation to difference of soil, as the experimental field in 1860 resembled intimately in composition and general character that on which the wheat experiments were performed in 1861. I can find no other solution for these and other difficulties and anomalies than by assuming that either the wheat-plant was not uniform in the experimental plots, or that the soil varied in depth and in its physical character, so far as this is affected by the nature of the subsoil.

I have good reasons to believe that the soil indeed varies in depth in different parts of the field. As the subsoil is retentive, the surface on the more shallow parts of the field in wet seasons often will remain soaked with water, when in deeper places the excess of water can percolate to a greater depth before it is arrested by the subsoil. A larger portion of cultivated soil thus is left in a more perfectly drained condition, than on parts of the field where a retentive clay subsoil comes nearer to the surface. Where such inequalities in the depth of the soil exist, and where the subsoil is of a close, retentive character, the cultivated portion of the soil must be much warmer in some places than in others. Under such circumstances field-experiments cannot furnish perfectly uniform results.

The plant, moreover, on this field was not so uniform as I could have wished, affording in itself a strong indication of inequalities in the depth or character of the soil. Indeed the produce of a field when ascertained on several separate accurately-measured plots, say of $\frac{1}{8}$ or $\frac{1}{4}$ acre each, is the best practical test I know for ascertaining whether a field is uniform in its character or not.

Although the wheat experiments are vitiated to some extent by

circumstances over which I had no control, they are, nevertheless, practically useful in showing that a liberal outlay in the purchase of nitrogenized top-dressings is attended with great profit, particularly when the price of wheat is high. Nitrate of soda and salt are best adapted to stiffish soils in good condition, and a specially prepared mixed mineral and nitrogenized manure to the soils which possess rather a lighter character or are naturally poor. On light land I would recommend the following mixture, which I know from experience answers exceedingly well in an economical point of view:—1½ cwt. of nitrate of soda, 3 cwt. of common salt, 2 cwt. of Peruvian guano, and 40 bushels of soot.

The guano should first be passed through a fine sieve, and all hard lumps be broken up,—a work which will be much facilitated by the addition of some sharp siliceous sand to the lumps.

When sharp sand is not at hand, perfectly dry and sifted coal-ashes or burnt clay may be used instead. The nitrate of soda and salt should be passed in like manner through a fine sieve; and as these salts are always more or less damp, and therefore difficult to sift, it is well to mix them previously with a dry substance in the same manner as guano. The next step is to mix these sifted and finely-powdered manures with a sufficient quantity of burnt clay or coal-ashes to make up 20 bushels. These are finally mixed with the 40 bushels of soot. Thus we obtain 60 bushels of a manure, which will suffice for 3 acres. The 20 bushels which have to be used per acre will cost about 25*s*., and I have no doubt will be found a very economical and useful top-dressing for wheat.

The following table will show the commercial results of the experiment, the wheat being valued at 50*s*. per quarter, the price at which it was sold, and the straw at 30*s*. per ton:—

TABLE *showing the Money Value of Increase in Corn and Straw per Acre over Unmanured Plot, and Clear Profit after deducting the Price paid for Manures.*

Plot.		Money Increase in		Cost of Manure.	Clear Profit.
		Corn.	Straw.		
		£. s. d.	£. s. d.	£. s. d.	£. s. d.
I.	2½ cwt. Peruvian guano	2 19 8	0 6 4½	1 12 6	1 13 6½
II.	4 cwt. of wheat-manure	3 0 5¾	0 2 9½	1 12 0	1 11 3¼
III.	1½ cwt. of nitrate of soda	4 8 6	0 12 6	1 2 6	3 18 6
IV.	Unmanured	..	..	..	..
V.	1½ cwt. of nitrate of soda and 3 cwt. of salt ..	4 9 11	0 11 10	1 5 6	3 16 3
VI.	3 cwt. of salt..	2 2 6	0 1 9	0 3 0	2 1 3
VII.	2 cwt. of sulphate of ammonia	4 3 8	0 9 11	1 12 0	3 1 7
VIII.	6 cwt. of ulmate of ammonia	2 10 9	0 11 3	2 5 0	0 17 0

This table is sufficiently simple and intelligible to need no further remarks on my part. I therefore conclude this report on wheat experiments with an acknowledgment of the obligations under which I am laid by Mr. Coleman, Professor of Agriculture in the Royal Agricultural College, for the practical assistance which he has kindly rendered me in carrying out the preceding experiments.

Royal Agricultural College, Jan. 4, 1862.

III.—*Report of Experiments made at Rodmersham, Kent, on the Growth of Wheat by different descriptions of Manure, for several years in succession on the same Land.* By J. B. Lawes, F.R.S., F.C.S., and Dr. J. H. Gilbert, F.R.S., F.C.S.

It is highly desirable, in a practical as well as scientific point of view, to determine, by means of careful experiments, whether or not the action of particular manures on particular crops is substantially similar in different descriptions of soil, and in different localities. With a view to provide information on this subject, a series of experiments was commenced in 1851 by Mr. Keary, on the Home Farm of the Earl of Leicester, at Holkham, in Norfolk; the results of which were published in this Journal in 1855 (vol. xvi., part 1). The crop selected was wheat, and the arrangement of the manures was the same as on some of the most important plots in the experimental field here at Rothamsted (Herts), in which wheat has been grown every year since 1844. Sir John M. Tylden, who is the president of an agricultural club in the neighbourhood of Sittingbourne, in Kent, the members of which are accustomed to make visits of inspection of experimental or good practical farming, some years ago induced the club to pay such a visit to Rothamsted; after which they very liberally undertook to conduct, at their own expense, a series of experiments on the growth of wheat, the results of which would compare with those already obtained at Holkham, and with those of the experiments still in progress here at Rothamsted.

Accordingly, a field of $3\frac{1}{2}$ acres, at Rodmersham, about $3\frac{1}{2}$ miles from Sittingbourne, was set apart for the purpose, and divided into seven plots, of half an acre each, and the superintendence of the experiments was confided to Mr. George Eley, of Tong, who is the Secretary of the club.

The soil of the experimental field is described by Mr. Eley as "a mixed clay, upon a chalk subsoil, lying from 4 to 6 feet below the surface." The previous course of crops and management had

been as follows:—In 1853, turnips, dressed with 2 cwts. guano and 3 cwts. superphosphate of lime per acre, and the whole of the crop fed on the land; in 1854, barley; and a good dressing of London dung for beans in 1855; this being the usual preparation for wheat in that locality. The land was, therefore, to use Mr. Eley's words, "in a well-cultivated and fertile state." It was, in fact, as the results will show, in higher condition than was desirable when the object was to determine the character of the exhaustion, and therefore the character of the manures required for the crop, in that particular soil, under the ordinary system of cropping and management adopted. The action of the different manures was, however, sufficiently characteristic after the first crop of wheat had been taken.

The manures were always mixed at Rothamsted, from the same stocks as those employed for the Rothamsted experiments. The arrangement of the experiments, and the description and quantities of manure applied per acre, were as follows:—

Plot 1. Unmanured.

Plot 2. Mixed mineral manure, composed of—
300 lbs. sulphate of potass.
200 lbs. sulphate of soda.
100 lbs. sulphate of magnesia.
200 lbs. bone-ash
150 lbs. sulphuric acid* } Superphosphate of lime.

Plot 3. Ammonia-salts, comprising—
200 lbs. sulphate of ammonia.
200 lbs. muriate of ammonia.

Plot 4. "Ammonia-salts" (as plot 3), and "mixed mineral manure" (as plot 2).

Plot 5. 540 lbs. Peruvian guano.

Plot 6. 2000 lbs. rape cake.

Plot 7. 14 tons farmyard manure.

The above quantities were applied annually for the first three years of the experiments; the arrangement was also the same for the fourth year, with the exception that in experiments 2 and 4 the quantities of sulphate of potass were reduced from 300 lbs. to 200 lbs., and of sulphate of soda from 200 lbs. to 100 lbs. per acre. In the fifth and sixth seasons the crop was grown without any fresh application of manure.

By means of experiment 1, we ascertain the state of productiveness of the land without any manure, and so provide a standard by which to compare the effects of the different manures. By means of experiments 2, 3, 4, 6, and 7, it is ascertained whether a specially mineral, nitrogenous, or carbonaceous manure,

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* Sp. gr. 1·7.

or some combination of them, is the most effective; and by means of the guano (experiment 5), which is the cheapest so-called artificial manure containing a large proportion both of nitrogen and phosphates, we are enabled to judge whether increase of crop can be obtained profitably by the use of such a combination.

The results obtained in each of the four years in which the manures were applied, in the two succeeding years without manure, and over the total period of six years, are given in a series of tables as follow (pp. 34-38):—

Table I. The dressed corn per acre, in bushels and pecks, and the total corn per acre, in lbs.

Table II. The straw (chaff, &c.) per acre, in lbs., and the total produce (corn and straw) per acre, in lbs.

Table III. The increase per acre, by manure, of dressed corn (bushels and pecks), and of total corn (lbs.).

Table IV. The increase, per acre, of straw (chaff, &c.), in lbs., and the increase of total produce (corn and straw), in lbs.

Table V. The weight, per bushel, of dressed corn, and the proportion of corn to 100 of straw in the produce, and in the increase by manure.

In the first year of the experiments the unmanured plot gave about $32\frac{1}{3}$ bushels of dressed corn, and nearly 43 cwts. of straw per acre; the farmyard-manure gave only about $30\frac{2}{3}$ bushels of dressed corn, but rather more than 56 cwts. of straw; and the greatest increase obtained by any of the manures was between 4 and 5 bushels of dressed corn, and between 15 and 16 cwts. of straw. It is obvious that, even unmanured, the condition of the land was almost as high as was compatible with the healthy growth and proper ripening of the crop—that it was, in fact, scarcely in a state to require manure at all, and therefore not in a condition to show very prominently the characteristic action of the different manures employed. The best preparation would have been to grow a crop of wheat over the whole field without manure, before commencing with the special manures. It is unfortunate, too, that the manures were only applied during four consecutive years; that during the two succeeding years, without manure, the seasons were very unfavourable, and the land had become somewhat foul; and that the experiments were entirely stopped before the influence of the manures had ceased, and their whole effect been ascertained.

Notwithstanding the unfavourable circumstances above mentioned, the results of the experiments at Rodmersham are very valuable; and, taking into consideration the very different condition of the land, they are entirely confirmatory of the conclusions that have been arrived at from experiments made

EXPERIMENTS made at RODMERSHAM, KENT, on the GROWTH of WHEAT by different descriptions of Manure, year after year on the same Land.

TABLE I.—PRODUCE per Acre, of DRESSED CORN in bushels, and of Total Corn in lbs.

Experiments.	Manures applied* for 1856-7-8-9. (Unmanured in 1860 and 1861.)	PRODUCE PER ACRE. Each Year. 1856.	1857.	1858.	1859.	1860.	1861.	Total. 4 Years, 1856-9.	2 Years, 1860-1.	6 Years, 1856-61.	Average Annual. 4 Years, 1856-9.	2 Years, 1860-1.	6 Years, 1856-61.
	Dressed Corn; Bushels and Pecks.												
1	Unmanured	32 1¼	25 1	24 3¼	19 3	7 1	15 2	102 0½	22 3	124 3½	25 2¼	11 1½	20 3¼
2	Mixed Mineral Manure	33 0½	29 3½	29 1¼	21 2¾	13 0½	17 3½	114 0	31 0	145 0	28 2	15 2	24 0¾
3	Ammonia Salts	36 3½	34 2½	31 0	23 1	15 3	19 1½	125 3	35 0½	160 3½	31 1¾	17 2¼	26 3¼
4	Mixed Mineral Manure and Ammonia Salts	33 2¼	41 0	32 1½	27 0	18 0	21 1¾	133 3¾	39 1¾	173 1½	33 2	19 2¾	28 3½
5	Guano	36 2	38 3	31 3¼	25 0	17 1	21 0¼	132 0¼	38 1¼	170 1½	33 0	19 0½	28 1½
6	Rape-cake	37 0¼	37 0½	33 0¼	27 0¼	16 0	21 1	134 1¼	37 1	171 2¼	33 2¼	18 2½	28 2½
7	Farmyard Manure ..	30 2½	33 0½	32 3½	25 2	14 1	19 3¼	122 0½	34 0¼	156 0¾	30 2¼	17 0	26 0¼
	Total Corn; lbs.												
1	Unmanured	1959	1602	1501	1199	462	1032	6261	1494	7755	1565	747	1292
2	Mixed Mineral Manure	1975	1934	1815	1314	807	1171	7038	1978	9016	1760	989	1503
3	Ammonia Salts	2204	2190	1883	1392	917	1245	7669	2162	9831	1917	1081	1638
4	Mixed Mineral Manure and Ammonia Salts	1950	2570	1941	1620	1096	1395	8081	2491	10572	2020	1246	1762
5	Guano	2112	2446	1927	1508	1006	1371	7993	2377	10370	1998	1189	1728
6	Rape-cake	2233	2316	2008	1621	932	1412	8178	2344	10522	2045	1172	1754
7	Farmyard Manure ..	1822	2114	2026	1537	864	1288	7499	2152	9651	1875	1076	1608

* For full particulars of the Manures see p. 32.

TABLE II.—STRAW, and TOTAL PRODUCE (Corn and Straw), per Acre; lbs.

Experiments.	Manures applied* for 1856-7-8-9. (Unmanured in 1860 and 1861.)	PRODUCE PER ACRE. Each Year. 1856.	1857.	1858.	1859.	1860.	1861.	Total. 4 Years, 1856-9.	2 Years, 1860-1.	6 Years, 1856-61.	Average Annual. 4 Years, 1856-9.	2 Years, 1860-1.	6 Years, 1856-61.
	Straw (Chaff, &c.); lbs.												
1	Unmanured	4798	2486	2691	3395	1624	1833	13,370	3457	16,827	3343	1728	2805
2	Mixed Mineral Manure	6274	3154	3093	3277	2338	2309	15,798	4647	20,445	3949	2323	3408
3	Ammonia Salts	6528	4350	3825	4451	2686	2795	19,154	5481	24,635	4788	2741	4106
4	Mixed Mineral Manure and Ammonia Salts	6490	5310	5098	5887	3028	2889	22,785	5917	28,702	5696	2958	4783
5	Guano	6348	4834	4712	5408	3011	2780	21,302	5791	27,093	5326	2896	4516
6	Rape-cake	6430	4458	3809	4988	2715	2854	19,685	5569	25,254	4921	2784	4209
7	Farmyard Manure ..	6302	3234	3835	4264	2629	2984	17,635	5613	23,248	4409	2807	3875
	Total Produce (Corn and Straw); lbs.												
1	Unmanured	6757	4088	4192	4594	2085	2865	19,631	4950	24,581	4908	2475	4097
2	Mixed Mineral Manure	8249	5088	4908	4591	3145	3480	22,836	6625	29,461	5709	3313	4910
3	Ammonia Salts	8732	6540	5708	5842	3603	4040	26,822	7643	34,465	6706	3822	5744
4	Mixed Mineral Manure and Ammonia Salts	8440	7880	7038	7507	4123	4284	30,865	8407	39,272	7716	4204	6545
5	Guano	8460	7280	6639	6916	4017	4151	29,295	8168	37,463	7324	4084	6244
6	Rape-cake	8663	6774	5816	6610	3646	4266	27,863	7912	35,775	6966	3956	5963
7	Farmyard Manure ..	8124	5348	5861	5801	3493	4272	25,134	7765	32,899	6284	3883	5483

* For full particulars of the Manures see p. 32.

TABLE III.—INCREASE per Acre by MANURE; Dressed Corn, bushels, and Total Corn, lbs.

Experiments.	Manures applied* for 1856-7-8-9. (Unmanured in 1860 and 1861.)	INCREASE PER ACRE.											
		EACH YEAR.						TOTAL.			AVERAGE ANNUAL.		
		1856.	1857.	1858.	1859.	1860.	1861.	4 Years, 1856-9.	2 Years, 1860-1.	6 Years, 1856-61.	4 Years, 1856-9.	2 Years, 1860-1.	6 Years, 1856-61.
	Dressed Corn; Bushels and Pecks.												
2	Mixed Mineral Manure	0 3¼	4 2½	4 2	1 3¾	5 3½	2 1½	11 3½	8 1	20 0½	2 3¾	4 0½	3 1½
3	Ammonia Salts	4 2¼	9 1½	6 0¾	3 2	8 2	3 3½	23 2½	12 1½	36 0	5 3½	6 0¾	6 0
4	Mixed Mineral Manure and Ammonia Salts	1 1	15 3	7 2¼	7 1	10 3	5 3¾	31 3¼	16 2¾	48 2	7 3¾	8 1¼	8 0¼
5	Guano	4 0¾	13 2	7 0	5 1	10 0	5 2¼	29 3¾	15 2¼	45 2	7 1¾	7 3	7 2¼
6	Rape-cake	4 3	11 3½	8 1	7 1¼	8 3	5 3	32 0¾	14 2	46 2¾	8 0	7 1	7 3¼
7	Farmyard Manure ..	−1 2¾	7 3½	8 0¼	5 3	7 0	4 1¼	20 0	11 1¼	31 1¼	5 0	5 2½	5 1
	Total Corn; lbs.												
2	Mixed Mineral Manure	16	332	314	115	345	139	777	484	1261	195	242	211
3	Ammonia Salts	245	588	382	193	455	213	1408	668	2076	352	334	346
4	Mixed Mineral Manure and Ammonia Salts	−9	968	440	421	634	363	1820	997	2817	455	499	470
5	Guano	153	884	426	309	544	339	1732	883	2615	433	442	436
6	Rape-cake	274	714	507	422	470	380	1917	850	2767	480	425	462
7	Farmyard Manure ..	−137	512	525	338	402	256	1238	658	1896	310	329	316

* For full particulars of the Manures see p. 32.

TABLE IV.—INCREASE per Acre by MANURE; STRAW, and TOTAL PRODUCE (Corn and Straw); lbs.

Experiments.	Manures applied* for 1856-7-8-9. (Unmanured in 1860 and 1861.)	INCREASE PER ACRE.											
		EACH YEAR.						TOTAL.			AVERAGE ANNUAL.		
		1856.	1857.	1858.	1859.	1860.	1861.	4 Years, 1856-9.	2 Years, 1860-1.	6 Years, 1856-61.	4 Years, 1856-9.	2 Years, 1860-1.	6 Years, 1856-61.
	Straw (Chaff, &c.); lbs.												
2	Mixed Mineral Manure	1476	668	402	−118	715	476	2,428	1190	3,618	606	595	603
3	Ammonia Salts	1730	1864	1134	1056	1063	962	5,784	2024	7,808	1445	1013	1301
4	Mixed Mineral Manure and Ammonia Salts	1692	2824	2407	2492	1404	1056	9,415	2460	11,875	2353	1230	1978
5	Guano	1550	2348	2021	2013	1388	947	7,932	2334	10,266	1983	1168	1711
6	Rape-cake	1632	1972	1118	1593	1091	1021	6,315	2112	8,427	1578	1056	1404
7	Farmyard Manure ..	1504	748	1144	869	1005	1151	4,265	2156	6,421	1066	1079	1070
	Total Produce (Corn and Straw); lbs.												
2	Mixed Mineral Manure	1492	1000	716	−3	1060	615	3,205	1675	4,880	801	838	813
3	Ammonia Salts	1975	2452	1516	1248	1518	1175	7,191	2693	9,884	1798	1347	1647
4	Mixed Mineral Manure and Ammonia Salts	1683	3792	2846	2913	2038	1419	11,234	3457	14,691	2808	1729	2448
5	Guano	1703	3192	2447	2322	1932	1286	9,664	3218	12,882	2416	1609	2147
6	Rape-cake	1906	2686	1624	2016	1561	1401	8,232	2962	11,194	2058	1481	1866
7	Farmyard Manure ..	1367	1260	1669	1207	1408	1407	5,503	2815	8,318	1376	1408	1386

* For full particulars of the Manures see p. 32.

TABLE V.—WEIGHT per Bushel of DRESSED CORN; and Proportion of Corn to Straw.

Experiments.	Manures applied* for 1856-7-8-9. (Unmanured in 1860 and 1861.)	EACH YEAR.						AVERAGE.			IN THE INCREASE OF PRODUCE.		
		1856.	1857.	1858.	1859.	1860.	1861.	4 Years, 1856-9.	2 Years, 1860-1.	6 Years, 1856-61.	4 Years, 1856-9.	2 Years, 1860-1.	6 Years, 1856-61.
	Weight of Dressed Corn per Bushels, lbs. and tenths.												
1	Unmanured	59·5	61·5	59·0	57·5	54·0	61·3	59·4	57·7	58·8			
2	Mixed Mineral Manure	58·8	63·0	60·5	58·0	54·3	60·5	60·1	57·4	59·2			
3	Ammonia Salts	58·3	61·5	58·8	55·3	53·5	57·8	58·5	55·7	57·5			
4	Mixed Mineral Manure and Ammonia Salts	56·9	60·3	58·0	56·0	56·3	60·8	57·8	58·6	58·1			
5	Guano	56·9	61·0	58·3	55·0	53·8	58·8	57·8	56·3	57·3			
6	Rape-cake	59·4	60·3	59·5	56·5	54·0	61·0	58·9	57·5	58·5			
7	Farmyard Manure ..	58·3	62·3	60·5	57·8	54·0	60·5	59·7	57·3	58·9			
	Proportion of Corn to 100 of Straw.												
1	Unmanured	40·8	64·4	55·8	35·2	28·3	56·3	46·8	43·2	46·1			
2	Mixed Mineral Manure	31·5	61·3	58·7	40·1	34·5	50·7	44·5	42·6	44·1	32·0	40·7	34·9
3	Ammonia Salts	33·8	50·3	49·2	31·3	34·1	44·6	40·0	39·4	39·9	24·3	33·0	26·6
4	Mixed Mineral Manure and Ammonia Salts	30·1	48·4	38·1	27·5	36·2	48·3	35·5	42·1	36·8	19·3	40·5	23·7
5	Guano	33·3	50·6	40·9	27·9	33·4	49·3	37·5	41·1	38·3	21·8	37·8	25·5
6	Rape-cake	34·7	52·0	52·7	32·5	34·3	49·5	41·5	42·1	41·7	30·4	40·2	32·8
7	Farmyard Manure ..	28·9	65·4	52·8	36·1	32·9	43·2	42·5	38·3	41·5	29·0	30·5	29·5

* For full particulars of the Manures see p. 32.

at Rothamsted, and elsewhere, regarding the character of the manures required for the increased growth of wheat on land under the ordinary conditions of cropping and cultivation in our rotations. They are, moreover, perfectly consistent with the experience of common practice on the point.

It is worthy of remark that after the land had been well dunged, and grown a crop of beans, the greatest increase, especially of corn, obtained in the first year was where the manure was the most nitrogenous. Thus, the ammonia-salts alone, the guano, and the rape-cake, each gave 4 to 5 bushels' increase of dressed corn; whilst the mineral manure, and the mineral manure and ammonia-salts together, gave only about 1 bushel. The ammonia-salts alone also gave rather more increase of straw than any of the other manures—more even than the mixed mineral manure and ammonia-salts together. The produce of the unmanured plot in the second and succeeding years showed, however, that the condition of the land had then become reduced; and it is, therefore, from the average results of each of the different manures taken over a series of years, that we shall be able best to judge of the character of the exhaustion induced by the growth of the wheat crop in that particular soil.

It is proposed to make a few comments: first, on the produce during the four years of the application of the manures; secondly, on that of the two years after the cessation of the manuring, showing the influence of the residue of the manures previously applied; and then on the total amount of increase obtained in the six years by the different manures.

Plot 1. *Unmanured.*—As already observed, the produce without manure was, in the first year, about $32\frac{1}{3}$ bushels of dressed corn and nearly 43 cwts. of straw. In the five succeeding years it was, respectively, $25\frac{1}{4}$, $24\frac{3}{4}$, $19\frac{3}{4}$, $7\frac{1}{4}$, and $15\frac{1}{2}$ bushels of dressed corn, and about $22\frac{1}{4}$, 24, $30\frac{1}{4}$, $14\frac{1}{2}$, and $16\frac{1}{2}$ cwts. of straw. But, a part only of this great reduction in the produce was due to the reduction of the condition of the land as affected by previous manuring; for, as already said, in the last two years of the experiments the seasons were unfavourable and the land had become somewhat foul. Excluding the first year, the average produce of the next three years was $23\frac{1}{4}$ bushels of dressed corn, and $25\frac{1}{2}$ cwts. of straw; and the average of the five years, without manure, that is, excluding the first year and including the last two unfavourable seasons, was $18\frac{1}{2}$ bushels of dressed corn and $21\frac{1}{2}$ cwts. of straw. Here at Rothamsted (Herts) where wheat had been grown without manure for a dozen previous consecutive years, the average produce of the same five seasons was 16 bushels of dressed corn and $14\frac{1}{2}$ cwts. of straw, or $2\frac{1}{2}$ bushels of dressed corn and 7 cwts. of straw less than at Rodmersham

(Kent). But as a standard by which to compare the effects of the different manures during the four years of their application in the Kent experiments, it will be necessary to take the average of the first four years without manure, which was $25\frac{1}{2}$ bushels of dressed corn and about 30 cwts. of straw; against which there were at Rothamsted (Herts), over the same seasons, only $17\frac{3}{4}$ bushels of dressed corn and about $15\frac{1}{2}$ cwts. of straw, or not much more than two-thirds as much corn and half as much straw as at Rodmersham.

Plot 2. *Mixed Mineral Manure.*—This manure supplied potass, soda, lime, magnesia, phosphoric acid, and sulphuric acid; in fact, an abundance of nearly all the mineral constituents required by the crop, excepting silica. The average annual increase it yielded, over the four years of its application, was about 3 bushels of dressed corn and $5\frac{1}{2}$ cwts. of straw. This was almost precisely the same amount of increase of corn as was yielded by the same manures over the same seasons here at Rothamsted, but nearly 4 cwts. more straw.

Plot 3. *Ammonia-Salts alone.*—The quantity employed contained much more nitrogen than could be taken up by the increase of produce, and quite as much as can be employed for the average of soils and seasons without getting an over-luxuriant and laid crop. The average annual increase yielded over the four years of the application was about 6 bushels of dressed corn and nearly 13 cwts. of straw. This, again, was almost exactly the same increase of corn, but nearly twice as much increase of straw, as was obtained by the same manure, in the same seasons at Rothamsted, after their application there for a dozen years consecutively.

Both at Rodmersham and at Rothamsted, then, ammonia-salts alone increased the wheat-crop, for a series of successive years, considerably more than did mineral manure alone.

Plot 4. *Mixed Mineral Manure and Ammonia-Salts.*—This manure supplied the same mineral constituents as in experiment 2, and the same amount of ammonia, or nitrogen, as in experiment 3; but it contained no carbon, of which about 40 per cent. of the dry substance of the crop consists. The average annual increase it yielded over the four years was about 8 bushels of dressed corn and 21 cwts. of straw; or about 5 bushels more corn and $15\frac{1}{2}$ cwts. more straw than by the mineral manure alone, and about 2 bushels more corn and 8 cwts. more straw than by the ammonia-salts alone.

It has been seen that both mineral manures alone, and ammonia-salts alone, yielded almost identically the same amounts of increase of corn over the first four years of the experiments at Rodmersham (Kent) as they did over the same years at Rothamsted (Herts), where wheat had been grown for a dozen previous con-

secutive years. The increase of straw by each of these manures, used separately, was, however, greater in the Kent experiments than at Rothamsted. The effect was altogether different when the mineral and nitrogenous manures were used together;—the combination yielding an average annual increase of about 21 bushels of corn and 22½ cwts. of straw at Rothamsted, against only 8 bushels of corn and 21 cwts. of straw at Rodmersham. Not only was the annual increase of both corn and straw the greater at Rothamsted, but the actual produce per acre, per annum, of dressed corn, was greater by about 5½ bushels; though that of the straw was about 13 cwts. less.

In both localities, then, the mixed mineral and ammoniacal manure greatly increased the crop, and the increase was greater when the two were used together than when each was used separately. But at Rodmersham, where the land was in comparatively high condition, the heavy manuring tended to over-luxuriance, and excessive proportion of straw; whereas, at Rothamsted, with an average of about half a ton less total produce per acre per annum, there was a considerably greater actual amount of corn, and of course a greater proportion of corn to straw, and also a greater increase of both corn and straw.

Plot 5. *Guano.*—The guano employed supplied a large quantity of phosphate of lime, small quantities of alkaline salts, and rather more than four-fifths as much ammonia or nitrogen as the quantity of ammonia-salts of experiments 3 and 4. It yielded an average annual increase of about 1½ bushel of dressed corn, and 4¾ cwts. of straw more than the ammonia-salts alone; and only about ½ bushel of dressed corn and 3¼ cwts. of straw less than the mixed mineral manure and ammonia-salts together. It will presently be seen that the guano gave far more increase, in proportion to its cost, than any of the other manures.

Plot 6. *Rape-cake.*—The amount of rape-cake employed would contain rather more nitrogen than the ammonia-salts of experiments 3 and 4, but in a condition in which it would be more slowly rendered available for the plant; it would contain a considerable quantity of mineral constituents; also a large amount of carbonaceous matter, yielding carbonic acid in the soil. It gave only the same average annual increase of corn (about 8 bushels), and 6¾ cwts. less straw than the mixed mineral manure and ammonia-salts (plot 4), which contained a less total amount of nitrogen, and no carbonaceous matter whatever. This is perfectly consistent with results obtained at Rothamsted, which show the non-utility of supplying carbonaceous manure for wheat and other grain-crops.

Plot 7. *Farmyard Manure.*—The quantity employed would contain more of every constituent, mineral and organic, than the

crop to be grown; and it would supply a large amount of available silica, and a large amount of carbonaceous matter beyond that of any of the other manures. Notwithstanding this, it gave, over the four years of its application, an average annual produce of about 3 bushels less dressed corn and about $11\frac{1}{2}$ cwts. less straw than the mixed mineral manure and ammonia-salts; and about $2\frac{1}{2}$ bushels less corn and about $8\frac{1}{4}$ cwts. less straw than the guano—neither of which would supply either silica or carbonaceous matter. This result is also perfectly consistent with that obtained at Rothamsted and elsewhere. It is not to be concluded from this, however, that the farmer may with impunity grow large white-straw crops by means of artificial manures without a due supply of farmyard manure to the land at some period of the rotation.

Thus, the results obtained during the four years that the manures were applied, showed that mineral manures increased the wheat-crop but little, ammonia-salts much more, mineral manures and ammonia-salts used together more than either, or both, used separately; that Peruvian guano, containing both mineral and nitrogenous constituents, gave a considerable amount of increase; but that carbonaceous manures had no perceptible effect. They further showed that the condition of the land was higher than was desirable for the purposes of the experiments, the result of which was, not only that the seasons set a limit to the amount of crop, and therefore to that of the increase produced, below that which the manures might otherwise have yielded, but that the increase consisted of a very undue proportion of straw.

The first season after the cessation of the manuring (1859-60) was a very unfavourable one, and the produce on the permanently unmanured plot was only $7\frac{1}{4}$ bushels of dressed corn, and about $14\frac{1}{2}$ cwts. of straw. The next season (1860-61) was not very much better, and yielded, on the same plot, only $15\frac{1}{2}$ bushels of dressed corn, and about $16\frac{1}{2}$ cwts. of straw. But the whole of this decline of crop is not to be attributed either to gradual reduction of the condition of the land, or to the badness of the seasons; for, as already noticed, the land, which had for the first few years been very clean, had, by this time, become somewhat foul by the continuous cropping.

Although the produce of the continuously unmanured plot, which supplied the standard by which to compare that of the others, was so much less during these two concluding years of the experiments, the average increase of dressed corn on the other plots, due to the residue of the manures previously applied, was, in every case excepting that of the rape-cake, even somewhat greater than during the seasons of the application. The increase

of straw was, however, in every case excepting that of the farm-yard manure, less than formerly, and generally very much less.

Thus, the amounts of increase obtained for two years after the application of the manures had been stopped, further show that the condition of the land was too high for the full action of the manures in the years of their application. They also show that their influence was not even then exhausted; and further evidence of this is to be found in the fact, that calculation leads to the conclusion that, in these Rodmersham experiments, there was a less proportion of the nitrogen supplied in the manures in the four years, recovered in the increase of the six years, and in some cases much less, than is sometimes recovered in the crop immediately succeeding the application of a nitrogenous manure. Under favourable circumstances, from 40 to 50 per cent. of the nitrogen supplied in an artificial manure for wheat may be recovered in the increase of a first crop. But it is estimated that, in the cases of the rape-cake and of the ammonia-salts alone, there was only about one-fourth, and in those of the mineral manure and ammonia-salts, and of the guano, under 40 per cent. of the nitrogen supplied in the manure of the four years recovered in the increase of the six years.

It will still be useful to give an estimate of the value of the increase so far obtained, by the side of the cost of the manures applied in one or two of the experiments.

The mixed mineral manures of plot 2 were far too expensive in proportion to the amount of increase they yielded, for it to be at all worth while to reckon the cost against the increase in their case. Looking to the objects in view, it was still quite essential to have the evidence of direct experiment as to their effect.

Ammonia-salts are, generally, neither so cheap a source of nitrogen, nor are they, when used alone, so good a manure for corn-crops as Peruvian guano, which contains a large proportion of phosphates as well as nitrogen. Rape-cake, though a recognised manure in the market for wheat, acts somewhat more slowly for the amount of nitrogen it contains than guano. It will be well, for the sake of comparison, to show the cost of the manure, and the value of the increase of the three manures—rape-cake, ammonia-salts, and Peruvian guano. This is done in the following table (p. 44).

Reckoning the value of the increase against the cost of the manures, there is a considerable margin in favour both of the ammonia-salts and the guano, but particularly of the guano. The evidence further goes to show that these active nitrogenous manures are by no means fully exhausted in the first year of their application. The quantity of guano used—nearly 5 cwts. to the acre—was, however, much more than is usually applied; indeed

TABLE VI.

Manures applied per acre in 4 Years.			Increase obtained per acre in 6 Years.				Cost of Manure.	Value of Increase.	Difference.
			Corn.		Straw.				
Description.	Quantities.	Price per Ton.	Bushels.	Price per Bushel.	Cwts.	Price per Cwt.			
	lbs.	£. s.		s. d.		s. d.	£. s. d.	£. s. d.	£. s. d
Rape-cake . . .	8000	5 10	46¾	7 0	75¼	1 3	19 12 10	21 1 4	1 8 6
Sulphate of Ammonia Muriate of Ammonia	800 800	15 0 20 0	} 36	7 0	69¾	1 3	12 10 0	16 19 2	4 9 2
Peruvian Guano . .	2160	12 10	45½	7 0	91¾	1 3	12 1 1	21 13 2	9 12 1

indeed, much more than it is desirable to apply in ordinary practice. Nor should it be inferred from the plan and results of these experiments, that the practice of growing a series of corn-crops by means of artificial manures is to be recommended. But when these results are considered by the side of those obtained at Rothamsted, Holkham, and elsewhere, and with the light of the common experience of almost every arable district of the country, the practical conclusion undoubtedly is, that highly nitrogenous manures much increase the produce of grain-crops under the circumstances in which these are generally grown in our rotations.

Peruvian guano, which contains a large quantity of phosphates, as well as nitrogen-yielding matter, is one of the best artificial manures for wheat; and 2 to 3 cwts. per acre, sown broadcast before the seed, and harrowed into the land, will generally be sufficient. When ammonia-salts are used, about 2 cwts. per acre may be employed, and 1 to 2 cwts. of superphosphate of lime should at the same time be applied. The above quantities are such as should generally be employed when the grain-crop is grown in the ordinary course of rotation, and the land is considered to be not highly enough manured to carry as heavy a crop as the average of seasons will well ripen.

But another great advantage to the farmer of the nitrogenous and phosphatic manures now in such general use is that, provided the land be well dunged once in the course of the rotation, he may, without injury to it, by their means frequently take an extra grain-crop in the course;—for example, barley or oats after wheat, as the description and condition of the soil and the locality may indicate. In such cases, 1½ time or twice as much of the artificial manure should be used as when the crop is grown in the ordinary rotation.

IV.—*Farmyard Manure.* By J. B. Lawes, Esq., F.R.S., F.C.S.*

Farmyard manure is generally looked upon as the natural manure of our crops. Artificial manures, on the other hand, are frequently supposed to be mere stimulants; and the very fact that but a small quantity of them may produce as much increase of crop as a very large quantity of farmyard manure is brought as an argument against the use of the artificial manures. A few observations upon the sources and the composition of farmyard manure may therefore be of service.

It is well known that the straw of our corn-crops and the solid and liquid excrements of horses and other animals fed in the stables, sheds, and yards, are the substances which contribute to form the heterogeneous mass called *farmyard dung.* Let us estimate what proportion of these various matters will, under given circumstances, be included in the complex mass, and thence endeavour to arrive at some conclusion as to its composition.

Suppose the case of a farm of 400 acres farmed on the 4-course

	Total Dry Matter.	Total Mineral Matter (ash).	Phosphoric Acid, reckoned as Phosphate of Lime.	Potash.	Nitrogen.	Nitrogen calculated as Ammonia.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
100 acres roots; half the crop = 6 tons per acre, consumed at home, give as manure ..	29,568	7,741	1686	2,411	2,512	3,050
100 acres barley: at 2500 lbs. straw per acre; 1-5th reckoned as food, and 4-5ths as litter, give as manure	198,333	11,138	916	1,574	1,213	1,473
100 tons of hay consumed at home, give as manure	94,080	14,818	2267	3,124	3,808	4,624
100 acres of wheat: at 3000 lbs. straw per acre; 1-5th reckoned as food, and 4-5ths as litter, give as manure	235,200	14,850	1634	1,948	1,746	2,120
Corn = 43,800 lbs. of oats, consumed by horses, give as manure	7,534	1,198	487	216	745	905
20 tons of oilcake (linseed, rape, and cotton seed), consumed at home, give as manure	9,930	3,295	2507	963	2,185	2,653
Total	574,645	53,040	9497	10,236	12,209	14,825

* This short treatise, which is extracted from an unpublished pamphlet by the author's permission, will be found highly suggestive as to the economy of fertilisers.—P. H. F.

system, that half of the roots and 100 tons of hay are consumed at the homestead, and that the whole of the straw of the corn-crops is retained at home as food and litter. Let it further be assumed that 12 horses have corn equal to 10 lbs. of oats per head per day, and that about 10*s.* per acre are expended in the purchase of cake for feeding stock. Under these circumstances the preceding table shows the amounts of the matters enumerated entering into the home manures of the farm in the course of the year.

These are, as nearly as can be reckoned, the average amounts of the constituents enumerated that would contribute to the home manure of the farm annually. But farmyard manure in the fresh state and before it has undergone much decomposition, contains about 70 per cent. of water, or 7 parts of water to 3 parts of dry matter. The 574,645 lbs. of dry matter would thus be combined with 1,340,838 lbs. of water, making together 1,915,483 lbs. = 855 tons (or an average of about 8½ tons for each of the 100 acres of root-crop), of *fresh un-decomposed dung.* In this state its composition, per cent. and per ton, would be as follows:—

	Total Dry Matter.	Total Mineral Matter.	Phosphoric Acid, reckoned as Phosphate of Lime.	Potash.	Nitrogen.	Nitrogen calculated as Ammonia.
Per cent ..	30·0	2·77	0·50	0·53	0·64	0·77
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Per ton ..	672	62·0	11·1	12·0	14·3	17·3

This is the composition of the fresh undecomposed dung calculated from the average composition of the matters which are supposed to enter into it.

The proportion of total *dry matter* given above is rather higher than the average of results obtained at Rothamsted with good box-dung; it is also higher than the average of the results given by Boussingault; but is lower than the amount given by Professor Voelcker for fresh dung.

The amount of *mineral matter* found by analysis in farmyard manure is generally at least once-and-a-half or twice as much as that contained in the clean food and litter, owing to the admixture of dirt. The amount of mineral matter in *fresh* dung due to the mineral constituents of the food and litter will probably seldom be much more than 3 per cent., but in rotten dung that has not wasted by drainage it may be considerably more.

The calculated amount of *nitrogen* given above is almost exactly the mean of the results of Boussingault and Voelcker on

fresh dung, but it is rather less than has been found at Rothamsted in good box-dung.

But farmyard manure undergoes very considerable diminution by decomposition, and especially when carted out and formed into clamps. Hence the land would not receive so large a quantity of matter as has been above estimated. The amount of organic matter diminishes very considerably, and in rotten dung the proportion of water is generally higher than above supposed. It also too frequently happens that both mineral matter and nitrogen are allowed to go to waste by drainage or other mismanagement. Otherwise, as the organic matter diminishes, the amount both of mineral matter and of nitrogen should increase in proportion to a given weight of the manure.

The composition and value of the manure is also very dependent upon the quality of the food consumed by the animals that help to produce it. Thus, if the same amount of dung had been produced from the same materials above mentioned, *excluding the 20 tons of oilcake*, the yard of manure would have contained 2185 lbs. less of nitrogen, equal to 2653 lbs., or considerably above a ton, less of ammonia; and every ton of the dung would have contained nitrogen equal to only about 14¼ lbs. instead of about 17¼ lbs. of ammonia. In the one case the dung would be called poor, and in the other the farmer might congratulate himself on having a yard of moderately good dung. Yet the whole weight of dry substance added by the oilcake to each ton of dung would only be about 11 lbs.! a quantity which is so small that neither the man that loaded the cart nor the horse that drew the dung to the field would detect it. If 40 tons instead of 20 tons of oilcake had been employed with the same amount of litter, only about another 11 lbs. of dry substance would be added to each ton of the manure, but the yard of manure would then be equal in quality to rich box-dung. In fact the consumption of 400*l.* worth, or about 40 tons of cake, would only add about 10 tons of dry substance to the manure heap, whilst the weight of Peruvian guano obtained for the same money would be about 30 tons.

It is quite immaterial to the growth of the crops whether the additional amount of nitrogen be purchased in the form of oilcake and so supplied to the land in the farmyard manure, or whether it be purchased and applied in the form of artificial manure, provided only that the requisite mineral constituents are not wanting. It is also a matter of indifference to the crops whether the necessary mineral constituents are supplied in the form of the excrements of animals or of artificial manures. The question is entirely one of economy, depending chiefly on the relative prices of meat and corn and of cattle foods and artificial manures.

Average Composition, Per Cent. and Per Ton, of various kinds of Agricultural Produce, &c.

	Per Cent.					lbs. Per Ton.				
	Total Dry Matter.	Total Mineral Matter (ash).	Phosphoric Acid, reckoned as Phosphate of of Lime.	Potash.	Nitrogen.	Total Dry Matter.	Total Mineral Matter (Ash).	Phosphoric Acid, reckoned as Phosphate of Lime.	Potash.	Nitrogen.
1. Linseed-cake ..	88·0	7·00	4·92	1·65	4·75	1971	156·8	110·2	37·0	106·4
2. Cotton seed-cake	89·0	8·00	7·00	3·12	6·50	1994	179·2	156·8	70·0	145·6
3. Rape-cake ..	89·0	8·00	5·75	1·76	5·00	1994	179·2	128·8	39·4	112·0
4. Linseed	90·0	4·00	3·38	1·37	3·80	2016	89·6	75·7	30·7	85·1
5. Beans	84·0	3·00	2·20	1·27	4·00	1882	67·2	49·3	28·4	89·6
6. Peas	84·5	2·40	1·84	0·96	3·40	1893	53·8	41·2	21·5	76·2
7. Tares	84·0	2·00	1·63	0·66	4·20	1882	44·8	36·5	14·8	94·1
8. Lentils	88·0	3·00	1·89	0·96	4·30	1971	67·2	42·3	21·5	96·3
9. Malt dust ..	94·0	8·50	5·23	2·12	4·20	2106	190·4	117·1	47·5	94·1
10. Locust beans ..	85·0	1·75	..	..	1·25	1904	39·2	..	..	28·0
11. Indian meal ..	88·0	1·30	1·13	0·35	1·80	1971	29·1	25·3	7·8	40·3
12. Wheat	85·0	1·70	1·87	0·50	1·80	1904	38·1	42·0	11·2	40·3
13. Barley	84·0	2·20	1·35	0·55	1·65	1882	49·3	30·2	12·3	37·0
14. Malt	95·0	2·60	1·60	0·65	1·70	2128	58·2	35·8	14·6	38·1
15. Oats	86·0	2·85	1·17	0·50	2·00	1926	63·8	26·2	11·2	44·8
16. Fine pollard ..	86·0	5·60	6·44	1·46	2·60	1926	125·4	144·2	32·7	58·2
17. Coarse pollard	86·0	6·20	7·52	1·49	2·58	1926	138·9	168·4	33·4	57·8
18. Bran	86·0	6·60	7·95	1·45	2·55	1926	147·8	178·1	32·5	57·1
19. Clover-hay ..	84·0	7·50	1·25	1·30	2·50	1882	168·0	28·0	29·1	56·[illegible]
20. Meadow-hay ..	84·0	6·00	0·88	1·50	1·50	1882	134·4	19·7	33·6	33·[illegible]
21. Bean-straw ..	82·5	5·55	0·90	1·11	0·90	1848	124·3	20·2	24·9	20·[illegible]
22. Pea-straw ..	82·0	5·95	0·85	0·89	..	1837	133·3	19·0	19·9	..
23. Wheat-straw ..	84·0	5·00	0·55	0·65	0·60	1882	112·0	12·3	14·6	13·[illegible]
24. Barley-straw ..	85·0	4·50	0·37	0·63	0·50	1904	100·8	8·3	14·1	11·[illegible]
25. Oat-straw ..	83·0	5·50	0·48	0·93	0·60	1859	123·2	10·7	20·8	13·[illegible]
26. Mangold-wurtzel	12·5	1·00	0·09	0·25	0·25	280	22·4	2·0	5·6	5·[illegible]
27. Swedish turnips	11·0	0·60	0·13	0·18	0·22	246½	13·4	2·9	4·0	4·[illegible]
28. Common turnips	8·0	0·68	0·11	0·29	0·18	179¼	15·2	2·5	6·5	4·[illegible]
29. Potatoes	24·0	1·00	0·32	0·43	0·35	537½	22·4	7·2	9·6	7·[illegible]
30. Carrots	13·5	0·70	0·13	0·23	0·20	302½	15·7	2·9	5·1	4·[illegible]
31. Parsnips	15·0	1·00	0·42	0·36	0·22	336	22·4	9·4	8·1	4·[illegible]

V.—*Recent Improvements in Haymaking.* By Mr. T. Bowick, Stoneleigh Abbey Farm, Warwickshire.

Prize Essay.

It has often been remarked, that while other branches of farm management have made rapid progress of late years, this department of the husbandman's calling remains nearly at a standstill. This view is in one respect correct; in another, its accuracy is questionable. The process of making hay—its manipulation so as to convert a growing juicy leaf into fodder in a state of dry fragrant preservation—is no doubt much the same as ever; be-

cause the essential conditions for doing this on a large scale are beyond man's control; and what he has to do is, simply to make the most of the opportunities presented to him. Therefore the old adage, "Make hay while the sun shines," still holds true, and will do so as long as haymaking is practised. But, on the other hand, more hay, and of better quality is now grown, consumed, and brought to market than formerly. A quarter of a century ago the parish of Kenilworth did not sell twenty tons of hay annually; and that limited quantity had in some cases little care bestowed upon it beyond being turned a few times in the swathe. Now at least one hundred and twenty tons of choice produce are each year sent to market. These facts may be taken as an average sample of the position of our Midland districts then and now: if some places could show a better account, others would be as far behind us.

Very fortunately our subject does not require a full description of the art and process of haymaking, otherwise we should be tempted, after the example of other agricultural writers, to follow the Middlesex account, either with or without an acknowledgment. We speak only of such improvements as are "recent;" and we are warranted in assuming that this word refers rather to modern as contrasted with old-fashioned ways than to any given term of years. An advanced farmer may have adopted, for ten years or more, practices which, to the world at large, are quite recent introductions.

It is evident, therefore, that these improvements must come under one or other of the following divisions:—

I. Lessened expense in the different operations; or,

II. Increase in the quantity or quality of the produce.

Although those persons who make a business of contracting for haymaking in its season are unwilling to submit to lower prices than formerly—say, for a crop of about 30 cwt., 15*s.* per acre for the complete job, including thatching—yet this does not prove that the process is not now more economically managed. Crops are generally heavier; such persons usually lack the aid of improved machinery; while, apart from this, the rise in wages is of itself sufficient to account for the price remaining comparatively the same. A century and a half ago an able-bodied man's wages in this locality was 6*d.* per day in summer, and 5*d.* in winter; they are now from 12*s.* to 14*s.* per week, while the increase in his comforts is by no means in the same proportion. And besides, the rates for work of the same character differ greatly in different localities.

A published statement of the cost of haymaking at Frocester Court, in Gloucestershire makes the hand-mowing only 2*s.* 6*d.* per acre, with 9*d.* for beer. The entire cost of haymaking is entered, in 1851, at 7*s.* 6*d.* per acre over 123 acres; in 1852, at 8*s.* 8*d.*; in 1856 and 1857, at 8*s.* In 1859 the mowing-machine was used, in addition to the hay-tedders and horse-rake; and the whole cost of manual labour in mowing, making, carrying, ricking, and thatching 170 acres was only 6*s.* per acre. Now here, with an average breadth of 200 acres or thereabouts, mowing by hand has ranged, in the past seven years, from 4*s.* 6*d.* to 6*s.* per acre; while the whole operation, including thatching, has varied from 17*s.* to 11*s.* 6*d.* per acre; which price we have not got below, even with the use of the mowing-machine, in the last two years. These, however, have been seasons of great summer rainfall, as the following extract from our register shows:—

	Rainy Days.		Depth of Rain.	
	June.	July.	June.	July.
1858	4	8	2·51	2·48
1859	11	8	2·45	2·95
1860	27	12	5·70	1·95
1861	18	25	3·01	4·30

A glance at these notes also proves most incontestably that, under any species of management, the state of the weather has much to do with haymaking results.* In the two drier years hay was well and easily got; while in the two latter, the operation bore a complete contrast to our earlier experience. In 1860 in particular the chief difficulty was how to make hay in cloudy weather alternating with pouring rain; and the chief lesson learnt was, that a strong staff of hands is essential. We managed, with one of Burgess and Key's implements, to dispense with half-a-dozen able-bodied mowers, while another half-dozen were also frequently taken from their work on pressing occasions. As regards the mowing-machine in that unfavourable season, although there were many annoyances arising from stoppages among tangled and heavy crops, yet we never lost an hour's carrying by keeping it at work, while it gave us a power over the whole operation which could not otherwise have been obtained.

This, therefore, leads us to refer to improved machinery as affecting the first branch of the subject. The haymaker, horse-rake, and mowing-machine, have tended greatly to diminish the amount of manual labour needed. The former implement has

* See Addendum on haymaking in a wet climate, p. 62, *infra*.

been more or less before the public for the past fifty years; yet even now we probably do not turn it to as much account as might profitably be done. Though many improvements have been made, its principle still remains unchanged. As to the best mode of proceeding, we are favoured with the following details, taken from his own practice, by one of the largest manufacturers of this class of implements.* "Our mode of haymaking," he writes, "is to put the tedding-machine into operation as soon as the scythes have got a fair start ahead, and to work the machine across the swathes *obliquely*—generally endeavouring to work with the wind sideways to prevent the hay being blown on to the horse. If the crop is unusually heavy, so that the tines of the machine cannot get hold of it all at one turn, we recommend that the field be twice gone over, the revolvers being a little raised from the ground the first time, and then lowered for the second bout sufficiently to complete the spreading after the grass has been allowed to lie for a few hours; the next operation with the machine should be performed with the second or backward motion. After reversing the action of the machine, the tines should be lowered till they just touch the ground; you will then turn over and lighten up the hay, without knocking it about as much as the first action does: we recommend that the use of the reverse action be continued until the hay is completely made.

"In selecting machines for preparing hay, we do not consider there is anything saved by purchasing those at a low price. It is also very important to select a strongly-made machine, with the main driving-wheel separate from the road-wheel, so that, in case of accident, it can be easily replaced without loss of time.

"It is generally acknowledged that hay made by machine is much better than that made by hand. As to the quantity of work, we consider our machine equal to twenty or thirty labourers; and as there are two strong springs to each fork-bar, the scattering is far more perfectly performed than it can possibly be by hand."

Although a good hay-tedding machine can perform the work of a score of hands, it by no means follows that these hands can in all cases be dispensed with. On old park uplands, where trees are abundant, or on low meadows where open trenches prevail, the work not being straightforward, an equal amount of saving cannot be obtained. But under most circumstances, with crops either light or heavy, the tedding-machine has told most advantageously both on the quality of the hay and the economy

* Messrs. Ashby and Co.

and expedition with which it is got together. In good weather the saving can hardly be over-estimated; in a wet season, hand labour has generally the preference—the reason being, that more turnings in the swathe, and less spreading abroad, is then essential. One great point in making hay is not to knock it about roughly when half-made; the tedding-machine should never be used above once with the forward action; it is too violent, and shakes out the seeds, clover, and finer leaves. A slow back-action is getting more and more into vogue; and the Leeds decision is a true echo of the opinion of intelligent men both among makers and purchasers. A quiet-lifting reverse-action, which just moves the hay to give free access for the sun and wind, is all that is needed in a good machine after the tedding has been fairly done. On very heavy crops a two-horse machine is desirable, which may either work with double shafts or with an extra wheel and pole—the latter being an exceptional arrangement,* though easier for the horses. For crops under 2 tons per acre, if not of coarse, tangled material, an implement of the common size is sufficient. The roller in front, for preventing the lodgment of grass, is a decided improvement, which may well be styled "humanity for the horse."

Scarcely second in importance for extensive crops is the horse-rake. Even where it is not employed for windrowing, there is a great saving of labour by dispensing with hand-rakes for clearing the ground. Supposing that you have three full sets of waggons or carts loading together according to the old system, with a pair of pitchers and one loader—all able and willing—to each cart or waggon, you require nine hands for raking after, in order to keep the work well together. Of these, six must be able-bodied men, and the remainder stout lads. This is on the supposition that, previous to the passage of the carts, the space between the rows has not been raked. By the use of a good horse-rake these nine hands—or twelve, if needful—are dispensed with. Nor is this all; for as the pitchers have not to wait for each raker to unburden his drag, the waggon or cart is loaded one-fourth sooner than would otherwise be the case. These men's services are therefore available for the rick or for pitching, or for any other duty. One man following with the horse-rake will keep well up with the work, and give it a better finish. A single-horse cart, with one man to pitch, a lad to load, and another to rake after, speedily clears up what the horse-rake has collected.

There is an advantage in this plan which must not be over-

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* See Mr. Pertwee's letter, p. 55.

looked. It is often possible to carry the bulk of a field when the rakings are hardly fit for going into the rick. In our late wet seasons this has frequently happened. But a still greater saving is effected when the hay is formed into windrows by the horse-rake. Admitting, as in the case of the tedding-machine, that there are circumstances—generally similar ones—under which the horse-rake cannot be profitably employed, we may still assert that hundreds of crops which are now got together exclusively by the old system of manual labour might be more expeditiously and more economically managed in the way suggested. For those who have not hitherto done so, these hints may be of service. Do not set the teeth too near the ground; if the crop is heavy, take out a portion of them, and, with careful management, the gain will be considerable. No rule can be laid down to meet every case; written descriptions can never supersede the guidance of common sense and practical experience. Many who possess the choicest implements make as great mistakes as other people. With reference to this, we have much pleasure in quoting some remarks with which Mr. C. Howard, of Biddenham, Bedfordshire, has favoured us:—

"This is not by any means a haymaking county, but the little that is made is done as cheaply as in any county in England. The system adopted by those who have these indispensable implements to cheap haymaking—the haymaker and horse-rake—is to shake the grass out with the former implement, then to rake it into small hacks, or more frequently, if the weather is fine, to dispense with that operation, and at once to drag it into windrows by the horse-rake. These rows are then shaken up by hand, or, if the hay is not too forward, by the machine. I generally prefer the former plan, as much damage is often done by the front action of the machine shaking a large portion of the leaf off. These are then turned by the back action, which, without shaking the hay too much, leaves it in a very light state for both sun and wind to act upon it. This may appear a rather summary mode of proceeding; but as the hay in our neighbourhood is largely grown upon meadows which produce a coarse description of grass, our great aim is to avoid doing too much to it, so that it may get some little heat in the stack. To economise labour must be the chief study of the farmer, if he means to be successful; and I know of no operation on the farm where this principle can be brought to bear so much as in haymaking. For with the machines I have named, and the mowers that are now coming largely into use, a farmer may do without any, or with very little, extra help during the busy season of haymaking. Good and useful as these machines are, judgment is required in

their use. I have often seen a haymaker going, with the hay in much too forward a state, doing it mischief. Care also should be taken in the setting of the horse-rake, that, while doing its work thoroughly, it does not pull up dirt, moss, roots, &c."

We now come to the latest though certainly not the least important of the improvements recently introduced among the implements used in haymaking. To say that *all* mowing-machines have answered wherever they have been tried would not be in accordance with facts. But where there has been failure with the use of a good machine, that failure has generally resulted more from bad or inefficient management than from anything else. Some persons have forgotten that the mower is not like a plough or a waggon, which might be entrusted into hands of second-rate efficiency. On visiting a "model farm" last year, at the close of harvest, we were rather surprised to see one of Burgess and Key's latest and most improved implements lying rusting outside, under the comfortless drip of an adjoining shed. "It would not answer here; we tried it for a couple of days," was the remark. One thing is certain, that if this specimen of the care taken for its preservation were also a fair indication of the trial it received, any disappointment or failure might be readily accounted for. At all events, with one of the very same make, we cut heavier crops, at the rate of an acre per hour, under circumstances much more difficult to deal with. Our mode of procedure was this: From among the best of the young fellows in the stable, that one who had the most of a mechanical turn was selected as driver. He had a youth in attendance, for throwing off any of the swathe that might be in the way at the turnings, and also for sharpening the spare-knife, that no delay might occur. In heavy crops, or when the ground was damp, a third horse was added in front; and the horses were changed about every three hours. This allowed two sets of horses to get through a fair amount of work, before carrying could possibly commence; so that no opportunity of carting a load was ever missed, through attention to the mower. In a good long day we could cut, and have cut, with the mower and six scythes together, eighteen acres of what is reckoned a full crop, on the banks of the Avon. The driver had a bonus of one pound for each of the past two years; and he left the machine in creditable order at the close of the season. On two occasions we had to telegraph to Newgate Street for the duplicate of a working part which had sustained injury; and the wanting portion was at our local station in six hours after date. But for a considerable amount of park-timber, and several awkwardly shaped meadows with open trenches, the number of men engaged in hand-mowing might

have been reduced to two or three instead of six. As a West Country farmer says, "High prices have been given in this neighbourhood for mowing during the past year or two, and the mowing-machine was introduced most opportunely, to prevent their being still higher." We cannot assert, as many have said, that the hay appears to be easier "made" after the mowing-machine than after the scythe; neither can we see that lying as it does so much more over the ground is an advantage in a wet season; but there is certainly so much closer and more level a cut with a well-made machine that the extra bulk of hay will, in some cases, pay for wear and tear and working expenses.

With respect to the preference to be given to different makers' implements, we are not called on here to offer an opinion. When we refer to that of Burgess and Key we simply cite our own experience. Wood's, however, has very justly been a general favourite; Samuelson's is also taking well in various localities. There is room enough for all; and we hope that all may get a fair trial; neither being thrown by the hedgeside, when the slightest hitch occurs, nor yet sent to the village smithy for repairs.

Mr. Pertwee, manager for Sir J. T. Tyrell, Bart., Boreham, Chelmsford, who has been very successful with the use of Wood's mower, has kindly supplied the following statement:—"Time is everything in the matter; and the man who makes, carries, and secures his hay in good order in the shortest time is the most successful manager. We set Wood's two-horse mower to work, which is a first-rate little implement, cutting upon an average from six to eight acres per day. The first day's work we allow to remain untouched, as left by the mower in small cuts or swathes, unless the weather should be very forcing; for I do not think it wise to move hay about too much. Next day, we use the shaker—Howard's, or some other—with this improvement, that we introduce, instead of a pair of shafts, a pole and an extra wheel, which takes all the weight off the horses' back, putting thereto a pair of light or old carriage horses. A man is mounted on the box, and drives away famously. The grass so shaken out is very soon made into hay, which we then rake into rows with the horse-rake. After this, we run up every row of hay so collected by Sir. J. Tyrell's cocking-rake (invented by himself), which draws together very large heaps, 8 feet high. Two or three men can follow with forks, and secure a large quantity in the afternoon, or on the appearance of a storm, in quick time."

The use of the mowing-machine very fortunately demands some amount of additional care in the preparation of the ground for its action. The chain-harrow, roller, and clod-crusher are all

profitable adjuncts for this purpose. Draining is also in some cases called for, in order that open trenches may be filled up. Thus, one point very greatly depends upon another: advances in one department of farm management call for corresponding advances in others. Levelling banks and high-backed lands must soon be the order of the day.

The use of carts, instead of waggons, in hay carrying, has been in some cases a great advantage. We find it so here; for one strong horse will take nearly as much on an old-fashioned broad-wheeled dungcart (furnished with suitable gearing) as many folks choose to place on a waggon drawn by two or three horses. But you will say that the waggon can be left beside the rick while the horses return afield for another load, whereas the horse must remain in the cart during the process of unloading. By having three props, one fastened to each shaft, and the other at the tail of the cart, this objection is done away with, and we have never had an accident arising from their use.

In respect to the ricks themselves, great improvements have taken place. Twenty or thirty years ago, a rick containing 25 tons was usually considered to be of full-sized bulk; consequently, with a multitude of small ricks, the amount of tops, bottoms, and outsides was considerable. But ricks of double that size are equally common now. And our own tastes lead us to prefer the hundred-ton rick, standing 20 feet to the eaves when well settled down, as being the most economical in erection (where the breadth of hay is large), containing less of inferior quality, improving that which is second-rate in itself, giving a larger proportion of hay fit for hunters or coach-horses, and therefore of greater value to the farmer as grower or seller. In making these large ricks a strong force of hands is no doubt essential; and a good rickmaker, who will both work well himself and keep everyone else to his post, is a decided acquisition, even at a high rate of wages. Portable scaffolds come into valuable use; and horse-power elevators—though giving the temptation to put large lots together with undue haste and consequent loss—form an investment which many will not be slow to adopt. Rick-cloths, too, sufficiently numerous, and of the requisite dimensions, are much more abundant of late years. They should be regarded as a *sine quâ non* on every hay-growing farm.

Before leaving the first part of the subject, one further improvement, of comparatively recent, and, perhaps, limited adoption, which affects alike the interests of employer and employed, the cost of labour, and the harmony and order of the farm, demands more than a passing notice. The custom, especially prevalent in the Midland, Southern, and Western Counties,

of paying for haymaking partly in money and partly in beer or cider, is one of which every farmer has found the annoyance. Does an accident occur?—"It was the beer that did it." Are there quarrels in the field; loud words and summary dismissals? —"The men had a drop too much." Does the work lag? Do the hands run to the pump the first thing in the morning?— The cracked lips and furred tongue tell the same tale. "The great point on which most of us err is in mistaking stimulation for strength: a pint of ale produces a temporary effect, which, however, terminates in reaction, and the man is no further on than he was before. Nothing but substantial and nutritious food can effectively repair the waste of the system."

Mr. C. Howard, whose letter we have already quoted, adds further:—"I hope you will show us how hay can be made without the use of so much beer. Endeavour to strike a blow at the system, which has caused so many misunderstandings between masters and men, and so much misery to families. *Beer*, BEER, BEER, is all the cry here in hay-time and harvest. I hope, however, to live to see the day when money-payments will be entirely substituted." These remarks need no comment.

From the same county, J. Tucker, Esq., Pavenham (late High Sheriff), favours us with the following:—

"For the past eight years I have annually mown and made into hay from 40 to 50 acres of grass and clover, and I believe during the whole of that time not a drop of beer has been brought into the field. We supply both mowers and haymakers with coffee before dinner, and tea in the afternoon, *milked* and *sugared*, as a substitute for beer, with which they are well satisfied. With a little system, and small expense for apparatus, a large number of hands can be readily supplied.

"If the hands are at work late—which they often are, in carrying and stacking—we give them bread-and-butter, with an extra supply of tea, and with this they will work for any reasonable time. As a question of cost, I do not believe—as I do it—that there is any saving; but even if more costly, I consider it a good investment, if only to teach the uselessness of strong drinks to working men."

From Somersetshire (Mr. Jarvis, Kilmington, near Frome), we have similar testimony:—

"I have now conducted my business eight years on strictly total-abstinence principles, and find it much better every way than the drinking system. It is not customary to give beer in part of wages in this locality from September to May. But in May it is usual to give men two pints of table-beer per day (until haymaking commences), instead of which I pay them one shilling

per week in cash, maintaining that cash is the only proper payment for labour. When we begin haymaking I pay 3*s.* per week instead of beer for fourteen weeks, which generally finishes up the harvest. The labourers provide themselves with a can of tea or coffee, which, when necessary, they warm in the back-kitchen.

"When I first adopted the plan I was told I should not find men to do my work without drink; but my experience is quite the reverse, as I have never lacked men, although I strictly prohibit any alcoholic liquors or smoking on the premises."

Coming farther north, we have been favoured by Mr. Wilson (Newlands, near Mansfield, Nottinghamshire) with the following account, which, though it has more special reference to the corn-harvest, still points to results substantially the same:—

"At the commencement of the season a stock of tea, coffee, and sugar is laid in, made up by the dealer into parcels suitable for use, according to the quantity required at any given time. The proportions are 1 oz. of tea and 7 oz. of sugar (cheap lump) to a gallon of water, with half a pint of milk; or 4 oz. coffee, 8 oz. sugar (brown) to about three quarts of water and one quart of milk. The apparatus required is simply a coffee-boiler, holding from 20 to 30 gallons, and a few tin or earthen vessels, of any kind, holding two or three gallons each. The foreman's wife has charge of the whole, and makes the quantity required three times a-day; or, in the case of carting late at night, another lot is made in the evening.

"A boy takes it round the fields, to the various parties engaged in cutting, &c.. If the quantity is not above 5 or 6 gallons he can manage it with two milk-cans and a pair of yokes on his shoulders; but usually he has a donkey with two large vessels slung to his sides, holding, when required, fourteen gallons each.

"The usual staff on the farm is about twenty men and sixteen boys, besides two or three men whose work prevents their taking a full share of harvest duties. The hay does not require much extra help; but in corn harvest we get twenty to thirty, or even more, extra hands. It is positively prohibited to bring any kind of intoxicating liquor into the field, and yet these extra men (from Derbyshire, Lancashire, Ireland, as well as our own neighbourhood), have never objected to the rule, or even made the slightest complaint. When I have put the question to them, they have in many cases at once stated that they felt the better for their abstinence, while none ever hinted that it interfered with his working ability. Neither has any man, or party of men, on this rule being explained to them, ever hesitated to engage themselves.

"The work is always let by the acre, *for money only*, and then an account is kept of the quantity of drink consumed by each party. This is charged to them at the rate of 4*d.* per gallon for tea, and 5*d.* for coffee, which is less than cost price, the object being to regulate the quantity according to each man's capacity or inclination. Some men will drink six quarts a-day, while the average consumption is from three to four quarts a-day. The weather will sometimes cause a variation of twenty-five or even fifty per cent. in the daily requirements. The men employed at carting and stacking the crop, which is paid for by the day, have their tea or coffee—as much as required—without any stoppage.

"We are quite convinced that the men have more regular appetites for nutritious food, that they enjoy better sleep at night, are more fresh and vigorous in the morning, do more work, and do it better than on the old system. Of course the saving to the men is considerable. Their drink only costs them about fourpence per day, while the ale and beer consumed in the neighbourhood, is seldom much under and often over one shilling per man per day: besides which, by doing more work, they earn more money.

"The insinuation has sometimes been made that they obtain the prohibited ale and beer 'on the sly.' This is probably true in some odd cases, but with close scrutiny I never detected but one such case in seven years; and I believe that there is very little deception practised even among the 'black sheep' who may creep in at a busy time among the other men."

Mr. Wilson's testimony is all the more valuable, since he has probably done more than any other man to elucidate this particular subject. Reader and writer must alike thank him for the above practical, AND PRACTICABLE, information.

This brings us to the second branch of the subject, viz.:—

Increase in the Quantity or Quality of the Produce.

This is a legitimate branch of our subject, because whatever affects the article grown, in either of the above respects, is naturally and intimately connected with the "improvements in haymaking," of which an account is requested. Whether the cost of "getting" is diminished, or the saleable bulk and value of the hay is increased, the farmer reaps the advantage. The cost of haymaking could be reduced to a minimum, by leaving the meadows or uplands without care, culture, or amelioration; but that would assuredly not tend to the profit of the occupier. So, on the other hand, the quantity and quality of the produce being greatly increased, a higher outlay for labour may in reality be at a lower rate than the former minimum.

Looking at the subject in this light, we have no hesitation in saying that as much improvement has taken place of late in this direction as in the simple manufacture of the produce. This progress we specially owe to the contributions of Messrs. Lawes and Gilbert to the Journal; a few years ago, it was scarcely recognised that both the quantity and quality of the hay crop are pretty much in the farmer's own hands. Put on ammoniacal manures, and you get a strong bulky produce, in which the ranker grasses predominate. Apply phosphatic dressings, and the clovers and finer grasses presently appear. Prepare a combination of the two, and a desirable result should follow.* Our manure manufacturers of repute, who have characters to lose, do this ready to our hand; and there can be no great hazard in putting on from 20*s.* to 30*s.* worth of such dressings per acre—in damp weather in February or March—whilst the prospect of a profitable return is highly encouraging. This refers to grass land which receives such applications regularly, or which is otherwise in good condition; with exhausted soils, more liberal treatment is required.

The following plan has been tried here extensively, and invariably with satisfactory results. Draw out a dunghill about Christmas, containing 300 yards of good yard-manure. Throw up in a heap six feet high, and mix with one ton of Peruvian guano, two tons half-inch bones, and two tons of salt. Turn a time or two, till the whole becomes a rich saponaceous mass. Then cart on the turf not later than February; apply to twenty acres—spread, chain-harrow, and spread again. After a week or two little will be seen of it; but at hay-time, as well as on the aftermath, the results are readily visible. Similarly, by the application of hot lime at from one to two tons per acre, on pieces of sour grasses, or under trees where the *Dactylis glomerata* abounds in all its coarse luxuriance, much improvement in the herbage is produced.

Some meadows also get into such a worn-out condition, full of moss and dry "bents," or stalks (which will take no heat in the rick though carried apparently much too soon), that something more is needed than the mere application of manure. Besides renovating the soil, the seeds of the right plants must be restored. We have for the past few years thus applied some quantity of seeds every spring. The change is evident. A gentleman who has had much experience in this line states his opinion that

* With reference to this assertion in the text, Mr. Lawes says—"The term *quality* must, however, be restricted to the superiority of the clovers and finer sorts of grasses to the coarser sorts of grasses. I do not think that we can, by any system of manuring, produce pasture on land of inferior quality, which shall have the fattening qualities of grass grown on land of the best quality."

"most of the meadows and other grass lands in this country might be increased in bulk of produce from thirty to fifty per cent., and the quality of the grass improved almost in the same proportion." Still it is probable that a considerable share of the benefit thus received is due to the accompanying cultural processes—no less valuable in themselves, although combined with other remedial measures. The case of a gentleman in the Isle of Wight, who says that from an application of good renovating seeds he had a return of 2½ tons of good hay per acre, where little but bents and rubbish grew before, is probably an exceptional one.

In some parts of Essex, a valuable plan is adopted for securing the marsh hay, and at the same time greatly increasing the bulk of the produce. The hay is cut while young and full of sap; it is then carted green, and mixed in layers all through the stack in the proportion of one load of barley or oat straw to four loads of hay. This combination makes better hay than would otherwise be secured; but does not produce an article suited to the market. Acting on this plan, we last season cut a seven-acre piece of light clover aftermath, and mixed it with four or five tons of nice sweet *wheat* straw. It heated moderately, and imparted an agreeable flavour to the whole. The little rick thus gained has supplied sufficient fodder for cutting into chaff to meet the requirements of fourteen horses throughout the winter. It has not, however, been put in their racks for their last baits at night.

Among the general improvements of recent introduction may be included that of earlier cutting. Practical botanists, like Professor Buckman, say that this is a step in the right direction.

Greater pains are likewise bestowed in finishing and in thatching the ricks than in former days. It is not so common to find hay ricks still uncovered a couple of months after the mass is got together. And the difference in cost between prompt action and following slower and more slovenly customs, is hardly worth the mentioning. Wet spouts, extending several feet down the stack, especially from the pitch-hole, spoiling probably half a ton of hay, are a certain mark of careless management.

How to make the most of weathered hay in a wet season, is a question which most consumers have at different times asked themselves. One says, give a peck of salt to the ton, and you will sweeten the lot. You may by so doing make it slightly more palatable; but the chances are that the deliquescent nature of the salt turns the whole into a mouldy mass, if the hay was not in the driest condition when got together. The writer has for three seasons adopted the following plan, which he with confidence recommends to others. Since he first published it, many

have tried it, both in making the ricks in summer and in using them in winter. The point aimed at is to give an aromatic flavour which shall be intrinsically good and safe in itself, and which shall at the same time render the hay or clover palatable to the stock fed upon it. This is accomplished by strewing a little of the following mixture in the rick, while in process of erection:—

	lbs.
Fenugreek,* powdered	112
Pimento	4
Aniseed	4
Carraways	4
Cumine	2

An outlay of 2*s.* 6*d.* per ton will afford a sufficient application in the majority of cases. And that horses or cattle will consume the compound in preference to better lots not similarly treated, we have had repeated and lengthened observation. An inquiry being made as to how it affected the health of the animals fed upon it, we were able last season thus to reply, "Our beasts, numbering 170 head, came out with more than average bloom in spring; and the cow-doctor's bill, from November to April inclusive (the hay-consuming months) has not run over threepence per head."

As an addendum we present a brief account of haymaking in a part of the country where the influences of climate present about as many difficulties as are often to be met with; for, after all, much more depends upon these influences than on the skill of man and the appliances within his reach. Does any one think that the fine green hay of Middlesex, or the useful but more highly coloured qualities of the Midland counties, could be made in the same way, or even made at all, with the dripping skies of Renfrewshire, or the West of Scotland? A landowner in that locality, D. Robie, Esq., Kilbarchan, near Paisley, who combines science with practice in an eminent degree, favours us for this paper with an account of the plans and practices there adopted.

If we look at the rainfall, we shall find a depth—and also a frequency of deposit—which would almost prevent hay being

* The use of fenugreek in small quantities has also been successfully introduced at the Duke of Bedford's Home Farm at Woburn. To store cattle consuming much straw-chaff with a moderate allowance of roots and meal, 2 oz. per head per day may be given with good effect. It is also useful for fattening oxen. This article is sold wholesale, unground, at a very moderate rate, about 15*l.* per ton. When ground and retailed, an enormous profit is charged. Every large farmer who has steam-power and millstones should purchase wholesale. The stones will be tainted for a while after this work, but the grinding of a few sacks of corn into meal for stock would probably set all right. A fair trade in such substances as this would soon supersede our much-puffed compounds.—P. H. F.

made with us further south, unless similar modes of action were adopted.

	Rainy Days.			Fall of Rain.		
	June.	July.	August.	June.	July.	August.
1860	20	8	18	5·85	4·87	5·35
1861	11	22	28	2·45	5·35	13·00

The register for August is also quoted, because the swampy flooded meadows are chiefly "made" in that month: in the two former months it is the "seed-hay" which is mostly saved. The successful plan, says he, in this dripping climate is to put it into small "coils" after being shaken out a little, each about the size of a beehive, and then with a sweep of the hand the tails are gathered under it, so that it gets the shape of an egg standing on the large end. After one or two days, according to the weather, every two are made into one, care being taken to put the surface of the old in the bottom and heart of the new coil; they thus remain till made into "tramp coles," containing 50 to 60 stone. Colour, scent, and juice are preserved much better than by spreading; and it is thus constantly protected against water. Here the old adage, "Make hay while the sun shines" is hardly applicable; but sun and light, though powerful agents for dissipating the natural sap, might be dispensed with. Aëration is indispensable. Bleaching has to be guarded against, by keeping the grass in small cocks repeatedly turned, and little spread out. In a succession of rainy days we do not turn swathe, because the upper portion has become impervious to rain. When it does dry up, turn no more than can be cocked. The juice, flavour, and colour are the great points to preserve: it is important to preserve the green matter of the leaves (*chlorophyll*). Therefore the action of the sun's rays are to be provided against—the preservation of flowers in green beauty, by bibulous paper, pressed hard down and repeatedly changed, but in the dark, suggests a caution against injudicious broadcasting to the sun's rays.

The preservation of seed-hay is effected in a most complete manner. After standing a day or two in the stook, it is stored in stacks containing some 24 to 36 sheaves, which, if made by a practised hand, are quite impervious to rain. The dexterity with which this simple operation is performed exceeds belief: it often happens that a rain-cloud may be seen pouring down its water in the distant horizon, but ere it arrives on the zenith of the observant husbandman, several acres of his hay-seed are already in the field stack. Thus it is saved, by being *stormed*, as the local phrase well expresses it.

February, 1862.

VI.—*The Rot in Sheep: its Nature, Cause, Treatment, and Prevention.* By James Beart Simonds, Professor of Cattle Pathology at the Royal Veterinary College, Veterinary Inspector to the Royal Agricultural Society, &c.

Introductory Observations.

We repeat but a truism when we say that the health of the animals of the farm, especially that of cattle, sheep, and pigs, influences to a considerable extent the amount of wholesome food which is available for the people; besides which, that it is also an abiding source of solicitude to the agriculturist, for upon it very frequently depends his own immediate success in the practice of his profession. Whenever, therefore, disease assumes an extraordinary type, spreading far and wide, and destroying in its progress many of the animals which supply our daily wants, the interests not only of the agriculturist, but of the entire community, are so far jeopardised, that on all sides inquiries are made as to the means which are best calculated to effect a diminution either of the extension or fatality of the malady.

During the past year—1860—an event of this kind was witnessed in the immense losses which occurred among sheep from rot: nor can it be affirmed that even now these have entirely ceased, or that any additional security exists against the disease being equally as destructive in succeeding years. Under such circumstances it is evident that benefit can alone arise from an accurate investigation of the pathology of the affection, as also of its causes, and of the laws regulating its spread. An inquiry of this kind was originally ordered to be made by the Royal Agricultural Society, which had, as its immediate result, the delivery of a lecture on the subject before the members, by the author of the present thesis. The views then given expression to were thought of sufficient practical importance to warrant their publication in a more available form for future reference than was afforded by the columns of the daily press; and accordingly the author was instructed to arrange the matter both for a pamphlet and also the pages of the Society's Journal.

Antiquity and Extent of Rot.

The frequent occurrence, insidious progress, and fatality of rot place it at the head of the most serious affections to which sheep are liable. In this country no single disease produces such destructive effects; but on the Continent its fatality is probably now and then equalled by the ovine small-pox, a malady against which our sheep are protected in a great measure by our insular position.

Rot is one of the most ancient diseases with which we are acquainted. The earliest writers on husbandry, as well as on the affections of cattle and sheep, make frequent mention of its ravages, and speak of a variety of causes as being in operation in producing it. Googe, Mascall, and Fitzherbert are among those of the 16th century; and Mr. Youatt, in his work on '*Sheep*,' remarks that even Hippocrates gave a very faithful account of the malady, "erring only in considering the flukes as hydatids; or rather his attention was confined to the hydatids, which are now frequently found in the liver of the sheep."

The disease would appear to belong to no particular country; and perhaps there are few if any parts of the globe where sheep have been domesticated in which it does not occasionally prevail. A fact of this kind is of much importance, because it goes very far to negative many of the views which are entertained with regard to *local* causes of the affection. For example, some persons in the present day speak of the deleterious effects of certain grasses, such as the "carnation-grass;"* but this, like many other plants, similarly regarded, grows only in wet and undrained localities, and, consequently, its existence is but an indication of dangerous pasturage. It may be affirmed that several of the supposed deleterious plants do not belong to Egypt nor to Australia, nor to many other parts of the world where rot is met with; vegetables of a special or particular variety being, as is well known, far more restricted in their distribution than even the lowest forms of animal life. Wherever, however, the disease is manifested, there the mortality will be found equal to our own, be this in the eastern or western hemispheres, in the torrid or frigid zones.

Mr. Youatt observes that "many sheep are destroyed by the rot in Germany. In the north of France," he adds, "they are frequently swept away by it, and in the winter of 1809 scarcely a merino in the whole of that kingdom escaped. It is destructive as far north in Europe as Norway, and even the most southern provinces of Spain have had occasion to mourn its ravages. It has thinned many a flock in North America, and in Van Diemen's Land and Australia it has occasionally been as destructive as on the worst undrained land in England."†

MM. Hamont and Fischer, of the Veterinary School of Abou-

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* Discussion on Rot. Royal Agricultural Society, February 20th, 1861. See also the Society's Journal, *passim*.

"Carnation grass," correctly speaking, is a sedge, the *Carex præcox*. It is well known in the eastern counties. It has a creeping root like couch—*Triticum repens*—and owes its name to the colour of its leaves, which are of bluish green or glaucous hue.

† 'Sheep: their Breeds, Management and Diseases,' p. 445.

Zabel, in their treatise on the disease—a translation of which will be found in the seventh volume of '*The Veterinarian*,' 1834—state that "it appears every year in Egypt after the fall of the Nile, and follows and keeps pace with the subsidence of the waters. In the superior parts of Upper Egypt it commences about the end of July; nearer Cairo in August; in the environs of the capital in October and November; and during the months of December, January, and February, in the Delta. It is most obstinate, and continues the longest, in the neighbourhood of the confluence of the waters. In Lower Egypt it lasts about 120 or 130 days, and it disappears soonest and is least fatal when the rise of the Nile has not been considerable. Desolation and death accompany it wherever it passes. The Arabs say that this pest annually destroys 16,000 sheep in Egypt, and that its victims usually perish on the twenty-fifth, thirtieth, thirty-fifth, or fortieth day after the apparent attack."

Without entering into further particulars of the ancient history or wide-spread existence of rot—the facts we have narrated being sufficient for our purpose—we pass on to speak of its various outbreaks in our own country.

Periodic Outbreaks.

The most reliable accounts we have met with of some of the early devastations from this disease are to be found in Ellis's *Shepherd's Sure Guide*, 1749. Speaking of "the great losses that several farmers sustained by the most noted sheep-rot of 1735," he says, "A farmer living in the vale of *Aylesbury*, who rented a farm of 165*l.* a year, declared to me he had lost two flocks of his folding sheep by the rot between May 1735 and May 1736, and thus came to great poverty indeed, for he never could surmount the loss of 300 sheep in one year.

"Another vale-farmer, living at *Stutely*, rotted his large flock by keeping them too long before he had them to market, and, when he did, the sheep were so lean that he could make no more than 6*d.* apiece of them, and at this price he sold 100 in Leighton market in October 1735, rather than drive them home again. He was sure they would die, and, dying under a lean rot, they would be only fit for dunging the ground with; for this rot came on so fast, and was so severe and general a one, that thousands of sheep were not worth offering for sale.

"This rot of sheep and lambs was the most general one, I believe, that has happened in the memory of man, because it rotted those deer, sheep, lambs, hares, and coneys, that fed on lands where rain-waters were retained on or near the surface of the earth for some time; and as I have elsewhere observed, the

dead bodies of rotten sheep were so numerous in roads, lanes, and fields, that their carrion stench and smell proved extremely offensive to the neighbouring parts and to passant travellers."

Ellis also describes another visitation in 1747, depending on a wet spring which succeeded a very mild winter. The rain, he says, began to fall at the beginning of May, and continued with but few intermissions throughout the month, as also that of June and part of July. "From all which," he remarks, "I would observe to my reader that a Midsummer rot ensued, and great numbers of vale-sheep became tainted by it, as did many also in the Middlesex grounds."

The year 1766 witnessed another and far more serious outbreak than that of '47. It is thus spoken of by Mills in his *Treatise on Cattle*, 1776. "Too rainy a season is very prejudicial to sheep, as was remarkably experienced *all over England* in the summer of 1766, when whole flocks perished with the rot."

The next visitation in the order of time, of which we have been able to collect some particulars, is mentioned by Dr. E. Harrison in his *Inquiry into the Rot in Sheep and other Animals*, 1804. He says that "in the year 1792 the country was uncommonly wet from the great quantities of rain which fell in the summer months, and this was a most destructive year to sheep and other animals. In the human subject, agues, remittants, and bilious autumnal fevers, were also prevalent in many places. Graziers soon took alarm and became very solicitous about their flocks. A breeder of rams informed me that to save his finest sheep he put them into closes which during an occupation of 40 years had never been known to rot, but he had the misfortune to lose them all. He was equally surprised to find that other pastures which had frequently produced the rot were this season free from it." Harrison adds, that, "upon inquiry I found that the suspected land was so much under water this year that the sheep were obliged to wade for their food; and that pastures of a higher, and consequently of a dryer layer, were, from the deluge of rain, brought into a moist or rotting state."

We come next to 1809-10, which appears likewise to have been a period of great fatality in some localities.

Fairbairn, who writes under the *nom de plume* of a "Lammermuir Farmer," states, in his *Treatise on the Cheviot and Black-faced Sheep*, that in 1810 his stock consisted of 2000 ewes, hogs, and dinmonts [shearling wethers], out of which he lost by rot during the winter and spring following above 800. He also says that in 1816 and '17 the Lammermuir farmers suffered in many respects from the severity of the seasons. He describes 1816 as being very wet and cold, but comparatively free from rot in consequence of the low temperature which prevailed. He says,

however, that "the year 1817 was again very wet, rather more so than the preceding one, and the average temperature of the season was several degrees higher than the other, which produced a very abundant growth of grass in the months of September and October, the ultimate consequence of which was that one of the greatest fatalities by rot followed to which the memory of man bears evidence."

The year 1824 proved likewise a very destructive one in wet and undrained districts. Among many other sufferers at that time was a Mr. J. Cramp, of the Isle of Thanet, who stated in his evidence before a Committee of the House of Lords, which sat in 1833 to inquire into the causes of the depressed state of agriculture, that in the winter of 1824 the rot swept away 3000*l.* worth of his sheep in less than three months, which compelled him to give up his farm.

Notwithstanding the serious losses which we have thus been enabled to particularize, perhaps the greatest outbreak that ever occurred in this country took place in 1830-1. It is supposed that upwards of two millions of sheep perished at that time. Evidence of this immense destruction was given by various witnesses before the Committee just referred to; and it was satisfactorily ascertained that in 1833, two years afterwards, "there were 5000 sheep on every market-day in Smithfield less than what used to be the average number, and 20,000 less than usual at Weyhill Fair;"* circumstances which may assist in showing the enormous loss which had been sustained by the country.

From 1830 to the present time several visitations, which were more or less severe, took place. One of these occurred in 1853-4, when many thousands of sheep were swept away, and not only in undrained districts, but also in others of a more healthy character. Since 1830, however, no outbreak can at all be compared to the one of the autumn and winter of 1860. Speaking in general terms, it may be affirmed that all the western and southern counties of England, together with several of the eastern and midland, suffered to a ruinous extent. As in former years, so in this, the attacks of the disease were due to an excess and long continuance of wet weather. Eighteen hundred and sixty will be long remembered by agriculturists, not only as producing the rot among sheep, but likewise for its baneful effects on the root crops, as also on the hay and corn harvests.

We are acquainted with several instances, in our own immediate neighbourhood on the verge of London, where the losses of sheep amounted from 600 to 700 in a flock. These sheep were

* 'Sheep: their Breeds, Management, and Diseases,' p. 445.

principally Welsh ewes, which had been bought at the latter part of the summer for breeding by being crossed with Leicester tups. Some persons lost nearly all, and one in particular, who buys about 800 of these ewes annually, had not more than 40 or 50 which escaped. Tups, wethers, lamb-hogs, and half-breeds, alike succumbed to the inroads of the affection. A similar fatality attended the progress of the disease in all other districts. In many parishes in Devonshire where we investigated the malady, and of which Bridgerule may be taken as an example, five-sixths of the sheep perished, or were sold for a few shillings each for slaughtering, to the detriment of the health of the poorer classes.* In the instance thus particularised the losses occurred among the stock of small occupiers, the ill consequences of which were greatly added to by their young cattle being found to be affected with flukes to such an extent as seriously to injure their health later on in the year.

In Sussex and in several parts of Surrey the fatality was equally great. In the neighbourhood of Eastbourne a flock of about 600 Southdown ewes of great value was completely destroyed. Numerous cases of this kind might be narrated, but enough has been said to show not only the extent of the disease, but that sheep of every description, and placed under different systems of management, equally succumbed. It is much to be regretted that means do not exist whereby the total loss could be ascertained. People are left in doubt as to the amount of food of which they were deprived in one year by this disease alone, and of the efforts which must be made to replace the losses. The time, we predict, cannot be far distant when agriculturists will be convinced, not only of the propriety but of the positive necessity of making returns, at least of the *losses*, they sustain among their cattle, instead of simply deploring these among themselves. Elsewhere we have drawn attention to this important subject, upon which very much might now be said, if it were not somewhat unsuited to an essay of this kind.

NAMES GIVEN TO THE DISEASE.

Various names, which are more or less expressive of certain conditional states of the system, are used in different localities to designate this affection. The one which is more generally applied is that which we have preferred to use in these pages, namely, "rot." It is not difficult to see that this term has had its origin in the evident unsound state of the animal during life,

* The Rev. S. N. Kingdon, the resident minister at Bridgerule, reported to the author, that on October 1st, 1860, 492 sheep were existing in the parish as the joint property of several small farmers; and that, by the end of the month, 410 of them had either died, or been sold at a price very little above the value of their skins.

and in the fact of the body undergoing quick putrefaction after death. Rot, however, like the majority of the names employed both in this country and on the Continent, fails to convey a sufficiently exact knowledge of the pathology of the malady. It is by no means easy to find a term which will do this, and which at the same time is also a suitable one for adoption by the public in general. The German term "*egelseuche*" is certainly far more expressive than many others; but even this does not admit of a better translation than the fluke disorder or infection. French veterinary surgeons usually designate the disease "*cachexie aqueuse*," which points to the dropsical condition of the organism of the animal in an advanced stage of the malady, referable to a bad habit of body. By the common people of France it is often called "*pourriture*," rottenness; and other terms nearly allied to this are also similarly employed.

In the western part of England, and particularly in Somersetshire, the disease is known as "*bane*;" the probable origin of the name being the baneful or injurious effects which attend its progress. In Dorsetshire, Devonshire, and Cornwall it is called "*coathe*" or "*coade*," which would seem to be derived directly from the Anglo-Saxon term "coðe," "*cothe*," or "*codhe*," signifying a sickly or fainting condition;* and may have been originally employed to show that a weak or debilitated state of the animal exists, which renders it incapable of exertion without tiring or fainting.

It may here be remarked that there are several diseases affecting sheep which pass by the common term "rot," a fact that explains why various opinions are entertained with regard to the disease by different observers. These persons in reality often describe two or more distinct affections, and hence they are not likely to agree as to their nature or cause. We occasionally hear such terms as "water-rot" and "fluke-rot," which would induce a belief that in one variety of the disease a dropsical condition of the body existed, and that in the other certain entozoa, commonly designated flukes, are located in a particular part of the organism. We desire, however, to confine the term "rot," if it is still to be used, to that affection in which flukes are present in the biliary ducts of the liver, setting aside entirely every other form of disease that has been designated by this name.

Assigned Causes.

There are few affections respecting which so great a diversity of opinion exists with regard to its cause, as rot. All kinds of

* Bailey's 'Universal Etymological Dictionary,' 1773. The Rev. R. Forby, in his 'Vocabulary of East Anglia,' 1830, gives "Cothe, *v.* to faint."

Cothe, pronounced Cōthēe, is much used in Norfolk to express that a person feels sickly, poorly, or faint.

theories have been put forth in explanation of it, many of which have been very wide of the truth. Scientific men of the present day may even be said to differ as much from each other as did mere empirics of past ages, or as now do the proprietors themselves of affected animals. Ere long we hope to see a greater agreement on this point; and especially are we encouraged in this, when we observe that many investigators, both here and on the Continent, are at work for its elucidation. Before giving our own views of this important question, we purpose, for the benefit of our readers, to glean from others, according to the date of their writings.

The earliest authors on cattle diseases, almost without an exception, so far as our researches have gone, regard the feeding on particular plants as the principal cause of rot. Leonard Mascall, "chief farrier to King James," in his work, *The Government of Sheepe*, 1587, original edition, says:—"It is good for al men to understand, especially shepheards, which things do hurt or rotte sheepe, whereby, they maie avoide the danger the better. Ye shal understand there is a Grasse or weed called Speare Wort, the leaves are long and narrow like a speare, hard and thick, the steales hollow, growing a foote or more high, with a yellow floure, which is comonly in wet places, and there wil it grow most, or where water have stood in the winter. There is also another weed called Peniwort or Penie-grass; it wil commonly grow in moist and marrish grounds, and it groweth low by the ground, and hath a leafe on both sides of the stalke like unto a penie, thick and round, and without floure, yet some doe saie it beareth a yealow floure, which will (as they say) kil sheepe if they eat it. Alsoe all manner of Grasse that land-floods doe overrun before a raine is not good for sheepe."

Gervase Markham, in his *Cheape and Good Husbandry*, 1614, repeats Mascall's remarks, and adds, that "knot-grasse is not good, nor meldewd grasse;" and also that "there bee little white snailes which a sheep will licke up, and they will soon rot him." He likewise speaks of the necessity of keeping sheep from off low and moist grounds, "untill the sunne be risen, and that his beames beginne to draw the dewe from the earth." In another place he comments on the propriety of chasing the sheep up and down the pasture, because "this chasing, first, beateth away mill-dewes and all other dewes from the earth, as also the webbes, kelles, and flakes, which lying on the earth, and a sheep licking up, doe breed rottenesse."

Crawshey, author of *The Countryman's Instructor*, 1636, says, that sheep get the rot "by feeding upon ketlocks or other such weeds, growing in fallow fields; or by feeding upon short grasse, on leighes or land-ends where many worme sprouts be, which the sheepe feeding upon that grasse doe licke up; also the gravell

wrought up by the worme, and most of all the slime that is left by the wormes ingendering, which is a great cause of rottenesse." He further adds, that "others get it by feeding upon low levell ground, where, when a sudden raine cometh, the water standeth and cannot get readily away, and the sheepe that continually useth that ground will slop much water with the grasse, which if the weather be cold will doe them hurt, but not so much as if it be warm: many shepheards say, that if the weather be hot, their sheepe will take the rot in four and twenty hours, therefore carefull shepheards, as soone as they see the ground wet and the day hot, will remove them with all speede into higher grounds, for a space, till the water be dryed away."

"A. S.," the anonymous author of *The Husbandman's Instructor*, 1697, remarks, that "in moist years sheep are subject to the rot, where in dry years they are exempted from it, and that not only from the moisture, for then would sheep rot in all moist grounds, but there is a certain putrefaction in the air, grass, or herb, or all of them, that cause it."

Bradley, a distinguished Professor of Botany in the University of Cambridge, in his *Gentleman and Farmer's Guide*, 1729, after repeating most of the preceding statements, goes on to extend the observations of Gervase Markham respecting snails and slugs, and remarks that "in some pastures there are great numbers of white snails and slugs, which while they are small the sheep take in with the grass, and are distempered by them. The snails and slugs breed about April and August, or September, so that at the times when they are smallest the sheep are in most danger from them. They breed for the most part in damp and shady grounds, and retire from their feed (upon the grass or other herbs) to their places of shelter about nine or ten in the morning, if the sun shine strong; but in wet weather they remain upon the grass constantly, so that sheep should not be turned into such pastures but in fair weather, or after the dew is off the grass; for when there is no dew or other wet upon the grass, the snail or slug cannot feed, and therefore is never abroad in the dry part of the day; so that in dry weather sheep are not in danger of the rot by these creatures."

Ellis, in the work previously alluded to (1749), dwells particularly on the rotting of sheep by their being pastured in meadows in which swampy places exist, and also in such as have a clay subsoil, rendering the surface retentive of moisture. He speaks likewise of the injurious effects of the animals eating "rank, flashy grass," and a certain weed called "bean-weed, which grows in the mossy grounds of vales." He asserts that "sheep do not take the rot even when land is flooded, but they take the cause of it after the waters are abated; for, as the sheep by this means have been kept off the grass for some time, when they come on it they meet with a

slime and dirt on it, which brings them under the rot; for nothing rots a sheep or any other creature more than such slime and dirt."

Ellis is more distinct in his statements about the injurious effects of "plaise-worms"—flukes (*see fig.* 2.)—in the liver, than any English author prior to his time whose writings we have perused. He narrates a case of a very large number of these entozoa being found in the liver, and, after describing their size and other peculiarities, proceeds to give the following hypothesis of their production:—"These destructive worms are, I suppose, bred by the corruption of blood, for the blood must be first vitiated by the sheep's feeding on unwholesome grass or weeds, or by poverty or otherwise, from whence are bred the seeds or eggs of plaise-worms, which, circulating with the blood, make their nest or lodgment in the fountain; that is to say, in the liver of the beast, where, if they cannot be killed, they will eat till they kill the sheep."

It will be unnecessary in this place to combat Ellis's views of fortuitous generation, or to expose his errors of physiology, our object being rather to show that a distinct opinion existed in his time, that rot was caused from flukes in the biliary ducts.

Passing by several authors of minor importance, whose works contain nothing original on this subject, we come in the next place to the celebrated Bakewell, of whom it is said that he often produced the rot at will in his sheep, to prevent any attempt being made to use them for breeding purposes subsequently to their sale. We find the authority for this statement, as well as an account of Bakewell's opinion of the cause of the disease, in Arthur Young's *Farmer's Tour in the East of England*, vol. i.

Young thus writes:—"Relative to the rot in sheep, Mr. Bakewell has attended to it more than most men in England. He is extremely clear, from long attention, that this disorder is owing solely to floods—never to land being wet only from rains which do not *flow*, nor from springs that *rise*. He conjectures that the young grass, which springs in consequence of a flood, is of so flashy a nature that it occasions this common complaint. But, whether this idea is just or not, still he is clear in his facts, that floods (in whatever manner they act) are the cause.

"Perhaps the most curious experiment ever made in the rot of sheep, is what he has frequently practised. When particular parcels of his best-bred sheep are past service, he fats them for the butcher; and, to be sure that they shall be killed, and not go into other hands, he rots them before he sells, which, from long experience, he can do at pleasure. It is only to flow a pasture or meadow in summer, and it invariably rots all the sheep that feed on it the following autumn. After the middle of May, water flowing over land is certain to cause rot, whatever be the soil.

"He has acted thus with several of his fields, which, without

that management, would never affect a sheep in the least; the water may flow with impunity all winter, and even to the end of April, but after that the above effect is sure to take place. Springs he asserts to be no cause of rotting, nor yet the grass which rises in consequence, unless they *flow*. Nor is it ever owing to the ground being very wet from heavy rains, unless the water *flows*. This theory of the rot" (adds Young), "upon the whole, appears satisfactory; and that part of it which is the certain result of experience, cannot be doubted."

The next author in the order of date (1804) whose opinions we shall notice with reference to the cause of rot is Dr. Harrison. We have already had occasion to quote from his writings respecting an outbreak of this disease in 1792.

Under the head of *Causes of rot*, he says, "the disorder has been imputed—

"1st. To a vitiated dew.

"2ndly. To a gruft, which adheres to the grass after wet weather, in the overflowing of running water.

"3rdly. To the luxuriant and quick growth of plants in hot, moist seasons.

"4thly. To grazing upon certain herbs; of which the Butterwort (*Pinguicula vulgaris*), White-rot (*Hydrocotyle vulgaris*), Round-leaved Sundew (*Drosera rotundifolia*), and the Long-leaved Sundew (*Drosera longifolia*) have been chiefly suspected.

"5thly. To Fasiolæ hepaticæ—flukes, or their ova—being introduced into the stomachs of animals by feeding on swampy and low grounds in moist weather.

"6thly. It is ascribed by Daubenton to poor diet and drinking too much water.

"7thly. It seems to be occasioned by poisonous effluvia, which under certain circumstances are emitted from marshy soils."

Dr. Harrison advances arguments against all these suppositions with a view to refute them with the exception of the last, which he endeavours to prove is the true and *only* cause. Speaking of the influence of the sun's rays on swampy ground, he remarks, "evaporation is copiously performed, and probably some of the water is decomposed, so as to generate in combination with other substances the poisonous effluvia, called *miasmata paludum*, which occasion the rot in animals." In another place he remarks, "for my own part I have declared for several years in various companies that marsh *miasmata* are the cause of both agues and rot."

Hereafter we shall offer some remarks on this opinion of Harrison's, especially as we find it adopted by modern authorities

on the diseases of sheep. In the mean time, we give the views of some other writers.

Hogg—The Ettrick Shepherd—observes in *The Shepherd's Guide*, 1807, that "it is a curious circumstance that of all other diseases of sheep, the greatest variety of opinions prevail with respect to the real cause of this, and amongst such a number it may reasonably be suspected that it is very difficult to alight upon the right one; but I have stuck to a theory laid down by a few of the most sensible men on the Duke of Buccleuch's estates, who have had abundance of experience that way, and which seems to account at once for all the different opinions. Yea, I hope to make it appear that all the various causes assigned for the rot only serve more fully to prove this the real and ultimate one. But, not to keep the reader in suspense, I hold it as an incontrovertible fact that *a sudden fall in condition* is the sole cause of rot."

Sir George Steuart Mackenzie in his *Treatise on the Diseases and Management of Sheep*, 1809, combats the Ettrick Shepherd's opinion, and asserts that "all the species of rot may be reduced to one, and *all the symptoms may be referred to unwholesome food.*" He says that "Mr. James Hogg and others assert that the rot is caused by 'a sudden fall in condition.' As these gentlemen do not mention what in their opinion occasions the fall, we may safely presume that it is not meant to ascribe it to any other cause than hunger. But hunger is not properly a disease, and its effects on the animal economy are very different from rot, whether the privation of food be sudden or gradual. Besides, we often hear of sheep having been buried in snow for weeks together, a situation in which they must be subjected to a fall in condition for want of food; but we never hear of sheep which have been so buried becoming rotten. This of itself is sufficient to overset Mr. Hogg's theory, notwithstanding that it is announced with an unusual degree of confidence. We learn from Mr. Hogg, himself, that sheep die of the rot while in good condition and even when very fat, and the whole account he gives of this disease seems to contradict his ideas respecting the cause of it. A sudden fall in condition may accompany the disease without having induced it. A sheep may continue to fill its belly and yet fall off. It is the cause of the transition from fatness to leanness, and not the transition itself, that ought to be looked to. If that cause be hunger, rot will *not* be the consequence, but the usual effects of starvation will follow."

Fairbairn, the "Lammermuir Farmer," likewise combats Hogg's opinion at considerable length, and among other things he remarks that "in no case that has hitherto come under my observation has '*a sudden fall in condition*' in the smallest degree

contributed to bring on this mortal ravager; nay, in many cases with which I have been most intimately acquainted, it could neither be traced with the strictest scrutiny to this source, nor did this follow even as the consequence of the disease."

D. Price, in his *System of Sheep-grazing as practised in Romney Marsh*, 1809, coincides in opinion with J. Lawrence, a well-known and contemporary writer on the diseases of cattle, that the affection is due to debility produced by excess of moisture in "*either the earth, air, or food:*" while R. Parkinson, author of *A Treatise on Live Stock*, 1810, favours the theory of flukes being the cause; but, like those who preceded him, gives no satisfactory account of their existence within the biliary ducts.

The "Lammermuir Farmer," in his *Treatise on Sheep*, 1823, previously quoted, considers the pasturing of sheep during the autumnal part of the year on meadows, where from the combined influences of warmth and moisture a superabundance of grass exists, as the cause of rot, and remarks that, "if any person can come forward and prove that it is not so caused, I shall freely grant that, with our present knowledge, the true cause still lies hid in the dark recesses of nature."

He also makes some observations with reference to the existence of flukes in the liver, which we transcribe, as thereby we have a distinct proof that the malady which he considers to be produced by luxuriant autumnal grasses is none other than the *true rot.* He says, "It is a curious and important fact that fluke-worms are found in the livers of all rotten sheep, and I have no doubt of these insects being the *immediate* cause of death, but how they come there has never yet been properly accounted for." He enters next on a dissertation as to the probable origin of the fluke, and concludes by remarking, "but in whatever way these worms are produced the fact is unquestionable that they are always *swarming in the liver of every rotten sheep;* and in proportion as a sheep is far gone in the disease the more numerous do they become; most certainly the two have some connection with one another, and that no small one, but whether they are the cause or the consequence of the rot remains yet to be determined."

Davy, in his essay read before the Bath and West of England Society, entitled *Observations on the Disease which has lately been so destructive to Sheep, called Bane or Coath*, 1830, does little more than reiterate the statements of others with regard to the causes, but dwells chiefly on enormous losses which were sustained during the year, and on the nature and prevention of the malady. His views of the pathology of rot will be hereafter referred to, as we find that to a very great extent they were adopted by authors of repute who wrote subsequently to his time.

To show that up to this period little more was known on the Continent with reference to the subject than among ourselves, we may here state that MM. Hamont and Fischer, whose investigations have been previously referred to (*page* 66), affirm that "all the veterinary surgeons of Europe agree with regard to the exciting causes of rot. Chabert, Dupuy, Hurtrel D'Arboval, &c., describe its prevalence in low situations; the feeding on marshy plants, as the different species of ranunculus, or plants which grow in or under water; the drinking of stagnant waters filled with insects, or where the fluke-worm and the leech abound; the infected air of the sheepcote, and the sudden change from dry to green food." MM. Hamont and Fischer, however, combat most of these opinions, and conclude by asking "whether the rot may not be an essential disease, dependent on a primitive alteration of the blood, due to watery food?"

The Arabs, they state, attribute this disease to the sheep feeding on a tender rushy grass, which they call *dysse*:—

"As soon as the waters of the Nile begin to subside, the pastures are covered with *dysse*. The sheep are exceedingly fond of it, and they are permitted to feed on it all day long, their feet being buried in the mud; and, as we have already said, for many months they have no other aliment. In the course of a very little time they begin to get fat, when, if possible, they are sold. Their flesh is then exceedingly delicate; but soon after this the disease begins to appear, and the mortality commences.

"In the neighbourhood of Abou-Zabel there is a vast tract of low land which the Nile overflows for two months. When the waters retire, it is found to be covered with these rushes. The neighbouring inhabitants hasten to drive their flocks thither, and they leave them on the marsh from the rising to the setting sun. Every year the rot carries off numerous victims; but it is a matter of general remark, that this disease is more frequent and fatal when the sheep are first turned on the newly-recovered pasture, than afterwards when the ground has become dried and the rushy grass harder."

We come now to a theory of the cause, which ought not to be too hastily rejected. It is founded on a knowledge of the manner in which many entozoïc worms are propagated, *namely*, directly by ova, which produce young worms precisely like the parent. Long prior, however, to the period we are now alluding to—1836—it was well known to scientific inquirers that the liver-fluke was an oviparous creature, and that it deposited an enormous number of eggs (*see fig.* 9) within the biliary ducts. It had also by some practical writers on the diseases of sheep been stated that flukes might originate from the eggs of "*some insects*" which had been deposited on the herbage, particularly of wet soils. Others, however, far better informed on natural history, suggested that the existence of the fluke in the liver was probably due to the ova of the parasite being conveyed into the digestive organs of the sheep while feeding on

particular grounds. The extensive promulgation of the latter opinion is chiefly due to the labours of Mr. E. King, who published some papers on the subject, both in the 'Scotch Quarterly Journal of Agriculture' and also in the 'Agricultural Magazine.' We have been unable to learn whether Mr. King, who seems to have resided in Oxfordshire, but who wrote from the "Steam-carriage Station, Hammersmith," had received a medical education or not; nevertheless he writes like a person well informed on the structure and functions of the animal frame, as also on natural history in general. We give the following quotations from his writings:—

"Flukes' eggs float in the gall, and go with it out of the gall-bladder into the intestine. Here they commingle abundantly with the contents of the intestines; and if the sheep be very full of flukes, the eggs so abound in the contents of the intestines that the smallest portion of a sheep's droppings taken up upon the point of a penknife and placed upon the object-glass of a microscope and wetted with a drop of spring water will show several of them. A buyer of sheep for stores, if he can find one fluke's egg by this mode of examination, would do well to decline purchasing such sheep.

"Hasty rain liberates flukes' eggs from sheep's droppings, and splashes them round about upon the circumjacent herbage; but healthy sheep, protected by their nose, are in little danger here of swallowing these eggs. The next shower, or perhaps the fag-end of the shower which liberates the eggs from the sheep's droppings, carries the eggs down to the earth or into the crowns of grass plants. If the soil be sandy or from any cause porous, the water soaks into the earth and leaves the flukes' eggs upon the surface, where they perish either by frost or desiccation. Such ground is therefore called *sound* land.

"If, on the contrary, the soil be very compact and clayey, so that the rain-water cannot soak into the earth, it draws off upon the surface, floating with it the flukes' eggs into the furrows, the ditches, the brooks, &c., and the flukes' eggs go wherever the flood-water goes. These eggs are so nearly of the some specific gravity as water that the least motion of the water keeps them moving; but they will settle to the bottom gradually wherever water is perfectly at rest. Wherever flood-water, carrying lots of flukes' eggs, finds perfect rest, there these eggs will settle; and many of them settle into holes, where, after the water has drawn away, they will perish in time by frost or desiccation, and then the meadow becomes safe pasturage for sheep; but for a long time whilst they are moist, and for a short time after they are dry, these eggs retain their vitality. The period at which their vitality becomes extinct I have been unable to ascertain.

"This is, however, a point of considerable importance to flock-owners to enable them to judge with some precision when they may safely venture to depasture meadows subject to floods. If attention be directed to this point, accidental occurrences and casual observation may elicit facts which will throw light upon the subject."

This theory of the introduction of the *ova* of flukes leading to the existence of the entozoa in the bile-ducts would certainly appear at first sight to have a good foundation; but it has been fully ascertained that it also fails to account for sheep becoming rotten.

Some ten years ago we put this to the test of direct experiment. We collected a far greater number of eggs, fresh from

the biliary ducts and intestines, and therefore in their perfected condition, than we can conceive it would be possible for a sheep to obtain during a summer's grazing, and exhibited them to an animal, using a little water as a vehicle. The quantity was not less than a teaspoonful; and as it is often impossible to count the number of ova in the field of the microscope, which may be contained in a drop or two of water, we can scarcely imagine the hundreds of thousands which were thus given to the animal. The sheep was kept six months before being destroyed, and, on examining its liver and other organs, *not a single fluke was found.* This negative result was exceedingly valuable, and it fully confirms similar experiments which have been carried out in Germany and elsewhere.

Gerlach, who is connected with the Berlin School of Veterinary Medicine, has had recourse to experiments of the same kind, and invariably with the like result; thus showing that the ova of the fluke when introduced into the digestive system of the sheep, will not develop into or generate flukes. It may be said that we have almost a continuous illustration of the fact in the enormous quantities of fluke eggs which enter the stomach and intestines of dogs belonging to butchers, farmers, and others, from eating the livers of rotten sheep. These animals suffer no ill effects therefrom, and we have never met with the entozoon in the biliary ducts of the dog, although our opportunities have not been a few in making autopsies of this animal. No doubt many persons will object to this illustration, on the ground that the dog is a carnivorous creature, and therefore animal products of this or any similar description would be quickly digested in his stomach. We admit the force of the objection; but we may reply, that flukes have frequently been found in some of the carnivora, both wild and domesticated, and also in the pig, who is, it is true, omnivorous, but whose digestive powers are notwithstanding little inferior, if any, to those of the carnivora. The entozoon has likewise been occasionally met with in man, another of the omnivora. It may be affirmed, therefore, that all these theories have been more or less at fault, and that it is only within, comparatively speaking, a very short space of time that we have approximated to anything like a correct explanation of the cause of rot.

The year 1837 witnessed the publication of the best work extant on the diseases of sheep, from the pen of the late Mr. Youatt, entitled, *Sheep; their Breeds, Management, and Diseases.* It contains a lengthy article on rot, in which Mr. Youatt not only gives his own experience, but culls from nearly all those who had written upon the subject. He comes to the conclusion that the disease is due to the inhalation of miasm, and hence that it

shows itself more particularly during the summer months, though in its progress the disease is carried over to the autumn, through the winter, and even into the next year.

His words are, that "floods in the latter part of the summer are generally precursors of considerable destruction from rot. The meadows when the water clears away must be in the highest degree dangerous. The grass at this time had begun to die, the outer leaves and some of the stalks were perishing; they wanted only the agency of heat and moisture to run into perfect decomposition. The rain comes, and with it the summer's heat, and the decomposition is rapid, and the extrication of poisonous gases profuse."

Again, "The nature of the herbage and the character of the plants which the soil produces have nothing to do with the development of the rot. It is caused simply by the extrication of certain gases or miasmata during the decomposition of vegetable matter, under the united influence of moisture and air."

It is, however, not a little singular that Mr. Youatt, in stating facts with reference to the disease, should name one which positively contradicts his theory with regard to miasm; and he appears to have done so without noticing it at the time. The fact to which we allude is thus given:—"A farmer, in addition to other land, had a dry, hilly sheep-pasture, which he stocked rather hard. In a hollow place of that pasture was a swampy pond, which was preserved for the sake of supplying the wheel of the thrashing-machine. The farmer, notwithstanding the dry and favourable nature of his sheep-pasture, had occasional losses from rot in his flock. He fenced in the pond, and prevented the sheep from having access to the swampy border that surrounded it, and the rot entirely ceased."

The circumstance of the cessation of the disease at once negatives the idea propounded with regard to miasm. If the pond had been thoroughly drained, the water being thereby entirely removed, and the character of the soil improved, we can understand that miasmatic vapours would have ceased to arise from it; but the pond still remaining as a pond, with its swampy border, miasmatic matter would spring therefrom just as much when it was enclosed with an ordinary fence as when it was open.

The theory of miasmata being the cause of rot has already been shown to have originated with Dr. Harrison in 1804, although long antecedent to his time the injurious effects of "bad air" had been vaguely alluded to. We may further remark that the miasmatic theory was revived by Davy in his essay on 'Bane,' published just before the writings of Youatt.

D. Price, previously quoted from, rightly observes that "many objections might be urged against this theory, however plausible

it may appear. I shall here content myself, however," he says, "with stating a fact recorded by the learned and ingenious Dr. George Pearson, in a letter to Arthur Young, Esq., which powerfully militates against the hypothesis in question," and he adds, "as this communication is valuable, not only for the fact it contains, but on account of the philosophical spirit which pervades it, I deem no apology necessary for presenting it to my readers in Dr. Pearson's own words :—

"The paper lately written by my friend Dr. Harrison on the rot of sheep is very valuable indeed for the great number of facts with which it is enriched. These facts are of various applications for the economist, the agriculturist, the breeder, and the practitioner of physic. The subject of the rot in general, I am persuaded, is in very able hands for further investigation, as Dr. Harrison's opportunities, from his residence, are most favourable. Hence, if I had leisure, I should not be inclined to occupy myself in this inquiry ; but it may, perhaps, be the means of eliciting or of confirming truth to state an apparent objection to the ingenious author's conclusion—'*that the rot is occasioned by the same morbific agent which occasions intermittent and remittent fevers.*' This morbific matter is called *miasmata paludum* in the schools of physic, and those miasmata are engendered especially in marshy and boggy grounds or fens, particularly in the spring and autumnal season. In some of the marshes of Kent intermittent fevers affect a great proportion of the inhabitants ; and even persons in the neighbourhood, although living on dry chalky lands, where these disorders never appear if remote from the low grounds, unless by importation. I was lately in Chitney Marsh, on the Medway, near the Isle of Sheppey, one of the most prolific situations for agues to be found in the kingdom. It is famous also for its pasturage, by which very great numbers of sheep are fed. Observing the sallow, and indeed cadaverous, countenances of the inhabitants, most of whom were ill or were recovering from agues, I was led to inquire into the health of the sheep. Besides the evidence of the fine healthy condition of these animals I obtained that of the shepherd, who had been so fortunate as to live thirty-six years in the marsh. He attested that he had only seen the disorder once, and that was in the first year of his residence, nor is the rot at all common in any part of Kent. The Leicestershire breed, he said, were subject to it, but not the sheep bred in the marsh ; nor were these animals subject to any other disease more frequently than in other situations in general, or particularly in the uplands. Hence it appears that one kind of miasmata of marshes which produce agues do not in all situations also produce rot. It is not, however, logically just to conclude from the instance I have given that *miasmata paludum* of a different species may not occasion the rot and also agues. It is possible, also, that some concomitant agents or circumstances may render the same miasmata productive of one of the diseases in certain situations, but not of the other disease."

Harrison also, like Mr. Youatt, narrates some cases of exemption from rot which militate very much against his theory. He says that "in 1792, the fatal year, &c., often particularised, Mr. Young of Claxby divided a flock of sheep and placed fifty upon some good aftermath, where, in other seasons, the rot had frequently prevailed. Only this part of his flock escaped the disorder, which he attributed to the meadow not having been grazed, before it was well covered and defended from the weather."

Again, he observes—"Some time since he (Mr. Young) purchased a close in his neighbourhood which was reputed to be unsound. Before any sheep were turned upon it, he permitted the grass to grow till it would cover a man's ankle, and during the whole summer he took care that it should remain an exceeding good pasture. The rot did not appear in the field, though an adjoining close in his own occupation, and another in the tenure of Mr. Thorpe, suffered more than usual during the year."

Harrison adds some further instances of a similar kind, and says in explanation of them, that "luxuriant pastures seldom rot unless they be *eaten bare* in hot weather. *Whilst the ground is well concealed, it is so completely defended and protected that the sun exerts no deleterious effects upon it.*"* Now, allowing this explanation to be correct, merely for the sake of argument, we may ask how was it that the miasm, which was engendered in the *adjoining* fields to an extent sufficient to rot all the sheep placed therein, did not cross the boundary fences and exert its prejudicial effects upon the sheep in these "luxuriant pastures," seeing that, being mingled with the atmosphere, it must be wafted hither and thither by every gentle breeze?

Harrison makes one remark, however, which may perhaps help us to explain the immunity of these animals in quite another way. He speaks of the danger of pastures being "*eaten bare.*" Now, it is well known, that sheep are remarkable for their close biting, for which their lips and incisor-teeth are beautifully adapted, and hence probably their greater liability to receive the cause of rot than the ox which crops the longer grasses. Holding the opinion which we do that rot is none other than an entozoic disease, referable to the entrance of the penultimate forms of the liver-fluke into the digestive system of the sheep, we conceive that an explanation is to be found in the circumstance that these creatures are in greater abundance at the lower portions of the stems of the grasses—the parts eaten by the sheep—than elsewhere on the plants.

Cleeve, in his *Essay on the Diseases of Sheep*, published in the first volume of the *Journal of the Royal Agricultural Society*, p. 310, narrates a fact singularly corroborative of the view we have taken. He says that in the parish of Seaton, in Devonshire, all the sheep that were depastured in the marshes one year were attacked with rot and died, *only excepting four;* on examining these four, it was found that they were *hog-jawed*, and, from the under jaw being much shorter than the upper, they could not bite near the ground."

* These italics are our own.

We may here leave the further consideration of this question for the present, to proceed with the history of the assigned causes.

In the year succeeding the publication of Mr. Youatt's work a small manual on the diseases of sheep made its appearance, from the pen of Mr. A. Blacklock, surgeon, Dumfries. This gentleman strongly repudiated the opinion of entozoa being the cause of rot, and considered that it arose solely from tubercles located in the lungs. He remarks that "everything that has a tendency to weaken the animal will more or less lead to rot. Exposure to cold and wet, mishaps at lambing-time, food bad in quality or deficient in quantity, and over-driving, will all predispose the constitution to the deposition of *tubercles.*" Hereafter we shall have occasion to recur to the writings of Mr. Blacklock, and will only now incidentally remark that the so-called tubercles in the lungs of sheep have no pathological relation to those met with in cases of phthisis of man. Since the period at which this gentleman wrote, it has been ascertained that these deposits are produced by the well-known entozoon, the *Filaria bronchialis.*

Subsequently to this date we do not find that any author of note has propounded any new views of the cause of rot. Mr. Spooner, of Southampton, however, after reviewing the statements of others, in his *History, Structure, Economy, and Diseases of Sheep*, 1844, remarks "it appears to me that in addition to the consumption of food in which water greatly abounds it is essential that this food should be in a state of decomposition (partially rotten) in order to produce the fatal disease."

We come next to comment upon the general statements which have been made with regard to the pasturing sheep on water-meadows. It has long since been ascertained that during a certain period of the year sheep are sure to take the rot if placed on irrigated meadows, this being from about June to October. The cause of this is to our minds very evident; but we must leave its explanation for the present, and reserve it for another section of our essay.

Arthur Young, when speaking of watering meadows in his *Farmer's Tour*, vol. iii., says "that Mr. W. White, a tenant of Mr. Frampton's, of Moreton, Dorset, remarked, and it is the general observation of the country, that these watered lands never rot sheep in the *spring*, though they immediately follow the water, or are turned in at any time or in any manner; but if they are turned into the *after-grass*, it rots till the autumnal watering, after which they are safe."

Much has been said with regard to the draining and improving of twenty-five acres of imperfectly-made water-meadow

belonging to the Duke of Portland, which for twenty years previous to 1826, when the improved drainage was effected, had carried *ewes and lambs* without the occurrence of rot, becoming subsequently thereto so dangerous to sheep that it invariably rotted them.* The field is described as being during twenty years so wet as to grow rushes and coarse water-grasses, but yet to be *safe* pasturage. This it might possibly have been in the spring, but not in the summer and autumn. We are bound to receive the statement as it is; but we nevertheless think the entire evidence, both with reference to the safety and the subsequent dangerous condition of the pasture, to be wanting in that preciseness which would bear a rigid investigation.

An analogous case has been published in *The Quarterly Journal of Agriculture*, which has so many features in common that it would appear to be identical, but for a slight difference in the dates and a few other particulars. This case received such an excellent reply from an anonymous writer under the signature F. B., which also appeared in the same journal, that, although somewhat long, we venture to transcribe both the case and reply, as thereby some light may possibly be thrown on the other instance:—

"On Water-Meadows causing the Rot in Sheep.—About the year 1808 some land, part of which had been under water, much of which was a bog, and part of which was nearly dry, was drained, levelled, and irrigated. Although it was drained and was so far dry that horses could at all times walk upon it, yet it produced coarse herbage, rushes, and even some flags. In this state it remained for at least fifteen years, and during the whole of the time it was constantly fed by ewes and lambs in the spring, and no instance was ever known of any of these sheep ever showing the slightest symptom of the rot.

"As, however, the herbage was not good, and it was supposed that by obtaining a better outfall and a more effectual mode of drainage the meadow might be much improved, it was broken up in 1829, drained more perfectly, better levelled, and was again laid down to grass after a turnip-fallow. The land then appeared to be perfectly drained. The turnips were excellent, and the grass which was sown in 1831 was beautiful. It was mown that autumn, after having been irrigated, and produced abundantly. It carried great flocks of sheep the ensuing spring, and produced a very great crop of grass early in the summer; but afterwards in that year the land appeared starved, and the grass did not come a second time to the scythe. In the spring of 1833 the meadow yielded a good pasture to the sheep, but, except in those parts which were dry and steep, it produced little for the scythe. Rushes made their appearance; and as it was probable that the land was not sufficiently drained, more drains were made, which produced a great deal of water. Then for the first time suspicions were raised that the sheep fed on the land were tainted by the rot, and it has been ascertained that since Christmas 1833 sheep fed upon it have taken the rot in five days. In the spring of 1834 more drains were made in it; the consequence of which has been a great improvement in the quality and quantity of the herbage, but, as far as the rot is concerned, it has been equally fatal to every sheep put upon it. It is necessary to add, that, although the whole of this meadow is now so well drained that after a fortnight's irrigation it will

* See Royal Agricultural Society's Journal, vol. i., p. 368 et seq.

become so dry in a week as to admit of horses galloping over it without scarcely leaving the print of their shoe, yet, as some parts of it are much lower, and consequently nearer the water by some feet than others, it might be supposed that they would be more likely to produce the rot than those parts which are higher. But this is not the case. It has been ascertained that they are equally infectious. Other meadows in this neighbourhood, irrigated partly by the same stream, have equally rotted the sheep though perfectly well drained. As those other meadows are entirely new, it cannot be said of them that there was a time when, though less well drained, they did not rot the sheep. They do not affect the question, What can be the reason why land which when less well drained was fed by sheep with impunity rots them now when it is much better drained?

"It cannot be attributed wholly to the seasons, because other water-meadows in the same county but on a different stream did not rot the sheep in the spring or even in the autumn of 1834; some few out of very many have been supposed to take the rot; and that in the autumn of 1834,* even on these meadows, scarce one has escaped the infection. But where they have taken it some parts of the land have not been effectually drained.

"These occurrences naturally excited attention, and recourse to every known means supposed to be capable of preventing this infection was resorted to. It has been said that sheep folded on fallows and not allowed to go on to their pastures till the dew was off the ground have escaped the rot, when others which were allowed to remain constantly on them have taken it; that dry food given to them on dry ground during the night, and that salt and oil-cake, have acted as preservatives. The evidence of the good effects of all these antidotes has been such as it was impossible to doubt. But each and every one of them has been tried here with the greatest attention, and it is painful to add that they have all failed in *every instance*. The mode in which these experiments were made was this: Out of a large lot of fat wethers which were in the course of being killed, and which were all believed to be sound, three at a time were selected for the trial of each of these remedies, and put on the meadows. At the end of three weeks their livers were invariably found to be more or less infected, while the livers of the others of the same lot which had not been on the meadows, and which had remained in their usual dry pastures, remained unaffected.

"This continued for some time; but at last two wethers which had *not* been on the meadows were found to have diseased livers, and therefore it cannot be affirmed with perfect certainty that the subjects of the experiment had taken the disease in spite of the remedies, because it is just possible that, like the two last, they might all have taken the infection at some previous period."

To this statement F. B. replied:—

"In vol. v. p. 503 of this Journal is an article entitled, '*On Water-Meadows causing Rot in Sheep.*' The very extraordinary circumstances detailed in that communication led me at first to think it an imaginary case, given to the public for the purpose of provoking discussion; as lawyers say, 'a case stated for counsel's opinion.' But on farther consideration I shall treat it as a real one.

"The writer says, 'About the year 1808 some land, part of which had been under water, much of which was a bog, and part of which was nearly dry, was drained, levelled, and irrigated. Although it was drained, and was so far dry that horses could at all times walk upon it, yet it produced coarse herbage, rushes, and even some flags. In this state it remained at least fifteen years,

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* In the autumn of 1833, 200 ewes were fed on these meadows, and, when killed, were all found to be quite sound.

and during the whole of that time it was constantly fed on by ewes and lambs in the spring, and no instance was ever known of any of these sheep ever showing the slightest symptom of rot.' To this part of the statement I have to observe, that ewes and lambs are not liable to rot when pastured upon water-meadows in *spring*. It would have been satisfactory to have been informed whether sheep of any kind were *close-pastured* upon the meadow in its then partially improved state, either *in wet summers* or *in autumn*, and what was the result of such pasturage?"

F. B. then quotes the whole of the second paragraph ending with the question—

"'*What can be the reason why land which when less drained was fed by sheep with impunity rots them now when it is much better drained?*'

"This negative question," he continues, "appears to me as if put for a similar purpose to that of the witty King Charles in regard to the weight of live and dead salmon; and in answer I will apply the sentiment expressed by one of the sages on that occasion: 'Before I assign a reason, I could wish to prove the fact.' On entering upon this discussion, it is but fair to acknowledge I do so under a considerable degree of prejudice, because I have experience of many instances of low marshy grass-land when in a state of nature, or but partially improved, rotting the sheep pastured upon it; and that land, on being subsequently thoroughly drained or converted into well-ordered water-meadows, did not rot sheep fed upon it in proper season. But I will endeavour to show, from the querist's own statement, it is probable that he has come to an erroneous conclusion in estimating the capability of his water-meadow.

"1. *The System of Irrigation.*—The most proper method of irrigating low marshy ground, such as the meadow described, is the bed or ridge system. It is not probable the meadow in question was so formed, because, if it had, the occupier would not have ploughed it up, cultivated it, and cropped it with turnips, as the re-formation of these beds with water-carriers and furrow-drains would have been attended with an unnecessary additional expense of from 10*l.* to 20*l.* per acre. Indeed it appears certain the meadow was not so formed, as he says, 'The grass-seeds were sown in 1831. They were mown in the autumn of that year *after having been irrigated*.' Now if water had been thrown over new-formed beds of loose cultivated earth, a great part of it would have been washed away, and the young grass-plants along with it. Neither is it probable his watering was done upon the catch-work principle, as that is not applicable to flat marshy land, such as a great part of the said meadow is described to be; and a loose formation of catch-work is still more liable to be guttered and the earth washed away than beds so formed. I am therefore led to believe the irrigation in question was something of the nature of warping, and effected by a rivulet dammed up, and the water from it caused to flow over the meadow at random, or with but little artificial direction; and although ewes and lambs may do well when pastured *in spring* upon land so managed, or rather mismanaged, yet sheep of any sort *close pastured* upon it *in wet summers* or *in autumn* would hardly escape rot, and that without any reference to whether the land was well or ill drained. The great advantages derived from the bed formations and catch-work systems of irrigation are the rapid flow of water over the surface, and quick delivery of it by the receivers and furrow drains, either to supply other beds at lower levels or convey it to the waste water channels, no water ever being allowed to stagnate upon any part of a well-ordered meadow. That desirable object cannot possibly be attained in warped or flooded meadows however much they may be drained, and hence the liability of such meadows to rot sheep.

"2. *The Quality of the Herbage.*—We are informed the land was sown with grass-seeds in the spring after the turnip crop, and that it was irrigated in the same year the seeds were sown, but the varieties of those seeds are not mentioned. If they were annuals or biennials, such as are commonly used in agriculture, they would of course soon die off, and all the tender and most nutritious of the natural grasses would be extirpated by the aration processes; while the roots of coarse grasses and other pernicious plants, so far from being eradicated, would in fact be renovated by the short course of arable culture. Indeed, it is purposely acknowledged, 'rushes again made their appearance in the second year after the seeds were sown,' and probably many other still more objectionable plants made their appearance at the same time. But even supposing the land had been sown with a proper selection of perennial grasses, these would have been weak in the second year. The narrator complains of his grass looking '*starved* after mowing in the second year, and that it did not come a second time to the scythe.' Also in the third year after sowing, he says, 'Except in those parts which were dry and steep, it produced little for the scythe;' the more valuable plants raised from seeds sown upon the low land being gone, and supplanted by pernicious plants as before stated. The sound pasturage on the meadow would be confined to a very narrow compass, and hence not without any reference whatever to draining.

"3. *The Manner of Pasturing.*—We are told that before the meadow was improved otherwise than by irrigation it did not rot ewes and lambs pastured upon it *in spring*. But it is not said it was at that time sound pasturage for sheep in *wet summers* or *in autumn*. Neither is it said that *after draining* it rotted ewes and lambs *in spring*. It is however stated that after the third draining in the spring of 1834 'the meadow was equally fatal to every sheep put upon it.' There is no mention of *the time of year* when the sheep were so put, nor is it stated whether the land was *full stocked with sheep* in that fatal pasturage. I, however, think that calamity took place *last autumn;* at least it is fair to infer so, because, as the third draining was effected in the spring of last year, the irrigation could not be carried on while the draining was in hand, consequently too late to produce early spring food; and if the meadow was mown for hay last summer, the fatal result will have arisen from the sheep eating the autumnal lattermath or fog, and not from the land having been more perfectly drained.

"Much more matter of a similar purport might be stated in support of my argument, but I trust I have already said sufficient to show that the querist has come to a hasty conclusion in supposing, as he states his case, 'that land when less well drained may be fed by sheep with impunity and rot them when much better drained.'"

In closing this section of our subject we would remark that neither water—pure or impure—innutritious herbage, nor noxious plants partaken of by an animal, nor exposure to rainy weather, location on damp and ill-drained pasturage, nor on water-meadows, in the abstract, can be regarded as the cause of rot. Singly or combined, if long enough continued, these influences exert their baneful effects upon the vital force, and by diminishing it render animals more susceptible to diseases in general, especially those of an asthenic nature. They fail, however, to produce rot, because, even if united with numerous other causes of a similar kind, they are incapable of producing the entozoa which are found in the biliary ducts of affected sheep.

We are not insensible of the injurious results which spring from the partaking of improper food, knowing full well that the due nutrition and integrity of every organ will depend very much upon this alone. We do not lose sight of the effects of a long-continued elevation or even diminution of temperature, a humid or dry atmosphere, on the *quality* as well as the quantity of the food itself. Neither are we unmindful of the consequences of a long exposure of the bodies of animals to the vicissitudes of weather; nor of the impaired function of respiration over the oxidation and decarbonization of the blood when the air is both warm and humid. The blood, we know, will be rich or poor, pure or impure, in proportion to the completeness of the change it undergoes by the process of respiration, and to the amount of albuminous and saline materials which enters it in a given space of time from the assimilation of the food. And further we are aware that it is by these means that it can alone maintain—assisted by the secretory and excretory organs—that purity of composition and proper specific gravity necessary for its free circulation, and the yielding up of its nutritive and vital properties to every tissue of the body.

But we object that many persons both write and speak about animals, and endeavour to explain the normal and abnormal functions of their several organs—particularly those employed in the digestion and assimilation of the food—entirely on chemical principles; as if an animal were merely a chemical laboratory. This we conceive to be an error. We admit the influence of chemistry—few perhaps more so—in many of the changes which are wrought in the animal organism; but we believe that this is controlled, kept in order, and, so to speak, even directed, by a far higher power, *namely*, vitality. Vital force, however, we do not hold to be antagonistic to chemical action, but to be in harmony therewith. Nevertheless, it is often diminished, without losing its supremacy, by many internal as well as other causes, especially if these should be of a persistent irritative character, as, *for example*, the presence of flukes in the liver. Under such circumstances a continued alteration of the function of one organ will exert a baneful influence to a greater or less degree upon all the others, and thus lead ultimately to the death of the animal by simply exhausting the vital force.

Pathology.—Rot an Entozoic Disease.

When we reflect that the pathology of a disease is to a considerable extent elucidated by studying the lesions which are observed *post mortem*, it seems difficult to account for the differences of opinion which have prevailed with regard to the nature of rot. It cannot be denied that every investigator of this disease

has had at command numerous facilities for observing the state of the organism *directly* after the death of the affected animal. Nor is this the only advantage he has enjoyed; for a few visits to the *abattoir* have sufficed to show the several stages of the malady from its earliest beginning to its fatal termination. In *slaughtered* animals, it is likewise to be remembered, that disease is always seen in all its exactness. Changes consequent on *natural* death have not come on, and there is, therefore, no mistaking the real for the unreal.

The advantage thus possessed by the veterinary pathologist over his medical compeer is very considerable. We fear, however, that too many have not sought this knowledge for themselves, but been content to adopt the opinions of others, who may perhaps have been equally devoid of practical information. In no other way can we account for the varying statements which have been put forth respecting the pathology of rot. Some writers, for example, describe the disease as being essentially an *inflammatory affection* of the liver. Others, on the contrary, view it as a *general dropsy* associated with *chronic* disease of the liver and an impure state of the blood, and one author, in particular—a surgeon—has even contended for its being a *tuberculous* disorder of the lungs.

The gentleman thus alluded to is Mr. Blacklock, whose writings we have before quoted from. He says,—

"The lungs are always the principal, and I may also, from my own experience, add, the primary seat of the affection. When examined in the early stage of rot, they have a hard lumpy feel, especially at the upper part or lobe; and at this time a great number of irregular yellowish-white, patchy-looking bodies will be seen shining through the membrane, *pleura*, which surrounds the organ. These *tubercles*, as the hard white bodies are called, vary in size from that of a mustard-seed to that of a pea. They are sprinkled through all parts of the lung, and will, in every dissection, be found in a variety of stages, from the firm condition in which they were deposited, to the softened state which denotes their speedy expectoration. Each tubercle, however small, usually holds a particle of calcareous matter in its centre."

The confidence with which Mr. Blacklock speaks of the matter will be further shown by one other short extract from his writings:—

"Fluke-worms and hydatids are almost constant attendants on rot, and seemingly most important ones, especially the former, which have, I may say, kept a great bulk of the learned and unlearned for many years in a perpetual bustle, and have so hoodwinked writers on this subject as to prevent them seeing the truly important points of the disease."

The opinions thus authoritatively put forth respecting rot being a tuberculous disease of the lungs have no foundation in fact. Indeed, as has been already pointed out, sheep are not subject to depositions in their respiratory organs of this *aplastic* material, which proves so destructive to mankind.

The little hard lump about the size of a "mustard-seed," holding calcareous matter, mistaken for a true tubercle, is the product of the *Filaria bronchialis*. Examined in the early stages of its formation, and when it presents little more than an ecchymosed condition, or a pus-like deposit, a *male* parent-worm will be seen coiled upon itself in the isolated miliary body. Having served the chief purpose of its life, the entozoon is about to die and become entombed in calcareous matter, his own structure contributing to this end by being involved in the process of calcification. Similar changes we believe to take place with the female parent-worms, but these, from their greater size and number, produce depositions far exceeding those of the male entozoa. In the still *larger and softer deposits*, which give here and there to the lung a flesh-like appearance, myriads of ova and *young* filariæ of both sexes will be found, which, by their local irritation, produce the changed lung-structure in which they dwell. These are the revelations of the microscope, and beautifully do they exemplify one form of entozoic disease to which sheep are remarkably prone.

Among the advocates of the opinion that rot depends on *inflammation of the liver* was the late Mr. Youatt. He spoke very decidedly on the point, and attributed all the lesions which are observed in the body to this one primary cause. This view of the pathology of the malady appears to have emanated from Dr. Harrison, who affirms that "Rot always commences with inflammatory symptoms, and generally with an exudation of coagulable lymph under the tunic of the liver. In five or six days after contracting the rot, the thin edge of the liver," he says, "becomes of a transparent white or bluish colour, and this spreads along the upper and lower sides, according to the severity of the complaint. In severe cases the whole peritoneum investing the liver is diseased, and then it commonly assumes an opaque colour, interspersed with dark red lines or patches."

Similar views were held by Hurtrel D'Arboval and by Davy. The latter-named author, after describing several morbid states of the liver, which he enumerates as "enlargement, induration, gangrene, concretions, &c.," says, "Now, we are well assured that these appearances never occur without the existence of previous inflammatory action. *Inflammation of the liver* is a state of disease which it is evident has taken place."

It is not a little remarkable that not only surgeons, but also such eminent veterinary authorities as Youatt and Hurtrel D'Arboval, should have committed so great a mistake respecting a disease of such common occurrence. Every farmer knows that sheep give little or no evidence of ill-health at the commencement of rot, and that, when they do sicken, the symptoms indi-

cate *not an inflammatory state* of the system, but a *marked debility and prostration* of the vital powers. We may here, however, leave the further consideration of this statement, more particularly as its fallacy will fully appear when we come to a detailed account of the symptoms of the disease.

Thus far the opinions we have quoted on the pathology of rot may be regarded rather as exceptions than otherwise, since the majority of authors agree in considering it as a dropsical disease, associated with a disordered liver, depending on an impure, watery, or improper diet.

In confirmation of this view it has often been said that both hares and rabbits take the rot in wet seasons and die therefrom. Our *post-mortem* examinations of these animals, when diseased, have not been many; but, singularly enough, up to the present time we have rarely failed to find flukes in the biliary ducts. The liver of the creature, however, has occasionally been enlarged and softened, and its vessels turgid with imperfectly clotted blood—very dark in colour. The general hue of the organ has varied, being in some places paler and in others of a deeper colour than natural. The animals have been little more than skeletons, and their abdomens have contained a good deal of serous fluid. The cause of death was obvious in these cases; but in all this we have only another proof that bad food will give rise to grave affections of the liver, by first impairing the quality of the blood.

The influence of food—natural grasses in particular—when *surcharged with moisture*, in producing a deranged condition of the liver of sheep, was made the subject of our investigation during the wet summer of 1860. We found that the first ill effects were a *blanching of the lobules* of the gland,—the structures which are mainly composed of the secretory vessels, bile-cells, and origins of the biliary ducts. Affected livers, apart from any other pathological condition, showed white spots and streaks here and there, which were often not more than five or six in number, and of a size not exceeding an inch and a half in length.

A continuance of the cause led to the production of further structural changes. No embryos of the fluke, however, could be detected even by a microscopical examination of the bile, &c. Had means not been adopted to prevent the further inroads of disease, doubtless these animals would have ultimately sunk from *dropsy;* but food the very opposite of that they had been living on, combined with a daily allowance of salt, sufficed at once to put a stop to the disorder, which assuredly ought not to be regarded as being rot.

To the opinion held by most authorities that rot in its advanced stages is accompanied with general dropsy, we willingly assent; but that the anasarcous condition of the body in *this disease*

depends, *ab initio*, on watery or innutritious diet, and allied causes, we cannot admit.

Dropsy will doubtless arise from causes which affect the quality of the blood or the functions of the liver, and not only in sheep, but in all animals, man himself not excepted. Dropsy, however, will not produce flukes in the liver, although the existence of flukes therein will produce dropsy. Until we cease to use such terms as "water rot," and begin to speak of rot as an entozoic disease only, we shall continue to impede the progress of veterinary pathology, by encumbering her with an unmeaning nosology.

Rot, we repeat, is an entozoic affection, due to the presence of flukes in the biliary ducts of the liver, which early lay the foundation for structural changes of a special description in this organ, and ultimately cause the death of the animal from anæmia. No author denies the existence of flukes in this disease, although it may be that every one does not make mention of them. The accounts of their presence within the liver are some of them of early date. Thus Sir Anthony Fitzherbert, in his *Booke of Husbandrye*, 1532, in describing the rot of sheep, says "if thou cut the lyver, there will be lyttle quickenes like flokes; and also seeth the lyver, if it be rotten it will break in pieces, and if it be sound it will hold together."

To those who object to the statement that flukes are the direct cause of the malady, may be addressed the question, How is it that sheep bred and reared on *sound land* have flukes in their livers in *wet* seasons, and then only; and that under such circumstances they die from rot? It is admitted that they are so affected. Where, then, do the entozoa *now* spring from? No combination of ordinary causes can produce them. No, their propagation and development are governed by fixed and unalterable natural laws.

When conversant with the natural history of the fluke, we see fewer difficulties in accounting for this fact than might be supposed; but we will not now anticipate this division of our subject.

Entozoic diseases have been much investigated of late, and every day's experience goes to prove that they are neither few nor unimportant. Hitherto it has been too much the custom to look upon entozoa as an effect rather than a cause of disease. Are they so in that condition of the flesh of the pig vulgarly called "measled pork," or in "gid" in sheep, or in "dyspnœa" in calves and lambs? If not, why should they be so considered in rot?

Men who are unacquainted with the facts which have been brought to light through long-continued research into the natural history of the liver-fluke, and who probably may possess far more practical knowledge of the details of feeding and managing sheep

to a profit, than do most scientific observers, will be sure to find enough to cavil at in the revelations of science. It is doubtless far easier to argue that all entozoa are the consequence of impaired animal functions, than by a patient investigation to become conversant with their structure, habits, and mode of development, with a view to understand the way in which they enter the bodies of animals and exert a deleterious effect on health.

Our own researches have recently brought to light another and a fruitful cause of the death of sheep of all ages, even under every variety of good feeding, management, and location, from the existence of an undescribed variety of worm of the class *filaria* within the abomasum—the digestive stomach. These entozoa, to the extent of many hundreds, fix themselves to the inner surface of the stomach, by inserting their heads into the mucous membrane, where they are enabled to keep their hold without much effort, despite the peristaltic action, by being furnished immediately behind their heads with four barbs, whose points are directed backwards, after the manner of a fish-hook.* The symptoms arising from their presence are remarkably akin to those of rot, consisting principally of long-continued wasting of the affected animal, leading ultimately to dropsy—death being not unfrequently preceded by diarrhœa. Surely these cases are not—because their progress, symptoms, and fatality are so analogous to those of rot—to be designated by that name: if so it will require but another step for it to be boldly asserted that sheep take rot, and die therefrom, when fed on the richest and best food, when located, bred, or reared on the lightest land, and when exposed to a long prevalence of the driest weather, for, as before stated, it frequently happens that under all these circumstances these entozoa abound in the stomach of the sheep.

To proceed. It is important to remember, as bearing on the pathology of rot, that flukes occasionally locate themselves in young lambs, and so impair the structure of the liver by their number as quickly to destroy the animals—often before the true cause is suspected. A case in point was a few years since brought under our notice. In September, 1853, we received from an amateur pupil of the Veterinary College, then residing at Redgrave in Suffolk, two portions of the liver of two lambs that had died after a few days' illness. The lambs were black-faced Norfolks, and had been bred on heath-land near to Thetford, where rot may be said to be unknown. They had come upon the farm just *six weeks* before, and were at once placed on

* At some future time we hope to describe the anatomical peculiarities of this interesting entozoon, and to illustrate these by microscopic sketches.

fen-land, part of which was marsh. Their death, as stated, was comparatively sudden, and the gentleman who sent the specimens found in each case, on making a *post-mortem* examination, that a serous effusion had taken place into the cavity of the abdomen, and that the liver presented well-marked indications of disease.

We were at once struck with the remarkable softness or pulpy condition of the liver, and on a close examination we ascertained that many of the bile-ducts were filled with entozoa, which proved to be very young flukes. The presence of these parasites in such numbers, and in animals so young, had, contrary to the general rule, produced a quick destruction of the integrity of the liver, with its several concomitants. It is a singular fact, but one which fully accords with our present knowledge of the natural history of the entozoon; that not a single *fully matured or parent fluke* was met with in these cases. Having preserved several of these entozoa, we here insert a sketch of a group of three of them of their natural size, as drawn to a scale.

Fig. 1. Young Distomata.

Vogel has spoken of the young distoma as being four lines long, and one and a half broad. The smallest of our specimens, however, as will be seen, had not attained even these dimensions.

Notwithstanding their diminutive size a microscopical examination showed that the nutritive system of these young distomata —aquiferous and bile-digestive—was fairly developed and in active operation, but that only an outline of their generative organs—the female portion in particular—existed.

Before leaving this division of our subject it is necessary to say a word with reference to the ordinary pathological changes which the liver undergoes from the presence of flukes. In general, unless the entozoa are very numerous, little structural change takes place until they have attained a fair size, and have travelled onwards from the main biliary duct, which they entered from the duodenum, into its various branches and smaller ramifications to deposit their ova. Their existence now produces pressure, persistent irritation, and increased vascular action, which ultimately lead to the coats of the ducts becoming thickened, and their calibre increased. In medical language hypertrophy, with dilatation, takes place. It is these changes which give an altered outline, and often an increased size, in some parts to the gland. Nature may be said to strengthen the walls of the ducts, even to their minutest divisions, to prevent the entozoa from

gaining access to the parenchymatous structure of the liver; and in effecting this she does not even stop at mere membranous development, but often deposits calcareous materials within the animal tissue. This gives to the liver its hardened condition, and likewise imparts a gritty sound on cutting through its substance. The same structural changes lead to a partial blanching of the lobules, and an impaired function of the bile-secreting cells, so that at length the entire organ becomes changed in colour, often presenting a yellowish clay-like hue, with which the enlarged main-biliary ducts greatly contrast, standing out on its surface as bluish white lines or bands. Much more might be said with reference to these pathological changes, but our description of the *post-mortem* appearances must not be anticipated, and therefore we pass onwards to our next division, *namely*, the

Anatomy and Natural History of the Liver-Fluke.

The branch of science commonly designated Natural History is acknowledged to be far more attractive than many others, and to possess allurements even for the uneducated. If this be so, it is easy to understand how men whose education and tastes fit them for such a study often become enthusiasts in its pursuit. It is well when investigations of this kind are not undertaken for mere intellectual gratification, but have for their end some praiseworthy object—the benefit, perchance, of the human race. It is this which gives a value, far beyond the simple attainment of knowledge, to researches into the history of parasites, because they mostly lead to the means of cure or prevention of the diseases which are due to the presence of these creatures. The introduction of the achromatic microscope has immensely increased the facilities for obtaining information on this subject, and has consequently led to the dispersion of many an error which had formerly prevailed. A new field of research has thus been opened up, and the wonders already revealed make the profoundest naturalist hesitate in expressing an opinion on any one point connected with the development of these creatures which he himself has not investigated.

Only a few years have elapsed since the scientific world was startled by the announcement of Von Siebold that the *Cyticercus fasciolaris*—the hydatid met with in liver of rats and mice—was only a "stray tape-worm which had become vesicular, and was, in fact, the *Tœnia crassicolis* of the cat." Shortly after this, even greater surprise, amounting in some persons to unbelief, was produced when the same distinguished naturalist affirmed that the hydatid of the brain of the sheep *cœnurus cerebralis*—the cause of the disease termed "gid"—was only the scolex of the *Tœnia serrata* of the dog; and that the detached segments of this worm,

in which its ova were alone perfected, would, if given to sheep, produce hydatids in the brain. Nor was this the only proof adduced in corroboration of the statement, for it was said that the converse was equally true—namely, that tape-worms were quickly developed in the intestines of the dog, by giving to this animal the so-called heads of the *cœnurus.*

A number of experimenters was thus called forth, in various parts of the Continent in the first instance, and afterwards in England, every one of whom confirmed the conclusions arrived at by Siebold. It was thus proved beyond disputation that some, at least, of the entozoa underwent regular metamorphoses, and that hydatids and tape-worms had a necessary and mutual dependence on each other. It could not be expected that investigations of this kind would end here, and it has since been shown that very many entozoa pass through far more complex changes than the tape-worm ; and that they often exist out of the bodies of the animals which they ultimately inhabit, in such peculiar forms, and for so long a time, as almost to set at nought the efforts of the helminthologist to unravel their several transformations. Among this number is the liver-fluke, the structure and metamorphoses of which we shall now attempt to describe, as it is upon knowledge of this kind that the means which, as pathologists, we possess for the treatment and prevention of the rot in sheep are based.

Technically speaking, the liver-fluke is known as the

Distoma hepaticum, or Fasciola hepatica.

The name *Fasciola*, to which many naturalists give preference, was originally bestowed on this entozoon by Linnæus, while that of *Distoma* was adopted by Retzius, under the belief, as would seem, that it was furnished with two distinct mouths—one at the anterior extremity (*a, fig.* 3), and a second a little behind the first named, on the ventral surface (*b, fig.* 3). The term *hepaticum* is employed in conjunction with Distoma to signify that the entozoon is met with in the liver.

The distoma belongs to the order *Trematoda*, a classification which denotes that it is a suctorial worm, and by most naturalists it is placed in the second family of this order. It will thus be seen that it is a matter of minor importance whether we speak of the creature as a liver-fluke, trematode worm, *distoma*, or *fasciola.*

Professor Owen, in his '*Lectures on the Invertebrate Animals*' (1843), says : " The *Trematoda* may be characterised as having a soft, rounded or flattened body, with an indistinct head, provided with a suctorious foramen, and having generally one or more sucking cups for adhesion in different parts of the body ; the organs of both sexes are in the same individual." From the same author we learn that Rudolphi, a pupil of Linnæus, adopted

external and easily recognisable characters for the generic subdivisions of the Trematode order according to the numbers and positions of the suctorious orifices and cavities. "When there is only a single one, it constitutes the genus *Monostoma;* when there are two, which are terminal or at opposite ends of the body, you have the character of the genus *Amphistoma;** when the posterior of the two suckers is not terminal, but on the inferior surface of the body, it constitutes the genus *Distoma;* three suctorious cavities characterise the genus *Tristoma;* five the genus *Pentastoma;* and a greater number that called *Polystoma.*"

Form and Size.—The *Distoma hepaticum* varies in size in the same animal, according to the age of the entozoon. Although this is the case, it is a singular circumstance, hereafter to be explained, that no distomata are found, even in long-existing cases of rot, so small as to warrant the belief that they had been hatched within the biliary ducts. The form of the entozoon is that of an oblong oval, flattened from side to side. Its greatest breadth is anteriorly, immediately behind the central sucker, from which point it gradually tapers to its caudal extremity. When fully developed, the distoma will attain a length of an inch and quarter, and a breadth of half an inch at its widest part. Many of the smaller specimens, however, do not bear the same proportion between their length and breadth, being somewhat rounder in form. It is, however, to be borne in mind, that on being removed alive from the biliary ducts, the creatures are seen to contract themselves, so as to appear very much smaller than they really are—a circumstance which has often led to an incorrect conclusion with regard to their real size, and consequently as to their age, and the length of time they had been located within the ducts.

Fig. 2.
Fully-developed Distomata.

We here insert an engraving (*fig.* 2) of two distomata of matured growth, which will assist our exposition. One of them is

* The fluke thus named is frequently met with in oxen and sheep, attached to the mucous surface of the rumen, in which situation it appears to be unproductive of mischief.—Author.

represented as exposing the ventral surface—that on the right—and the other the back or dorsal surface.

Colour.—The colour of the entozoon is found to vary, according to the amount of bile which is contained within its digestive system. If well filled with this fluid, the distoma has a dark-brown or occasionally a brownish-black hue ; on the contrary, if nearly empty, its colour is a yellowish-brown. Very frequently, however, some of its digestive tubes are replete with

Fig. 3.

Magnified view of the external surface of the *Distoma hepaticum*, showing the papillated state of the skin, with the oral and ventral suckers, &c.

dark bile while others are empty, which gives to the creature a peculiar parti-coloured hue.

External Surface.—When the external surface is examined with a low magnifying power, the skin is found to be thickly covered with minute papillæ which point towards the posterior part of the body. (See *fig.* 8.) In some specimens we have found only the anterior half of the creature thus covered, while in others no papillæ could be detected on any portion of the skin. These differences do not seem to mark any distinction of species, nor to be indicative of the age of the entozoon; but are probably owing to a casting off or shedding of the papillæ, as we see in so many other creatures. The epidermic portion of the skin is very thin and transparent, and appears to be homogeneous. It is best examined by stripping off a portion of the integument as a whole, when torn fragments of epidermis will be met with on the edges of the detached piece. The substance of the dermis or true skin appears to be composed of minute granules, arranged in some parts in a linear form both longitudinal and transverse, incorporated with numerous cellules.

Several of these peculiarities are very well depicted in *fig.* 3, on the preceding page, which represents a magnified view of the external surface of the entozoon. In addition to the papillated skin, the mouth or anterior sucker (a), the ventral or posterior sucker (b), and the so-called intromittent organ or penis (c), are represented.

Muscular System.—Immediately beneath the integument lies the muscular or contractile tissue, on which the various motions of the entozoon depend. In an animal the parenchyma of whose body is so pulpy as that of the distoma, it is almost impossible clearly to demonstrate the arrangement of the muscular fibres. It seems, however, that most of them run in a longitudinal direction and others transversely, while some would appear to cross these at angles more or less acute. Towards the mouth the fibres are stronger and more clearly developed, as they also are about the region of the ventral sucker, their special arrangements, however, in regard to these organs will be hereafter considered.

Aquiferous System.—Traversing the parenchymatous and other structures in every possible direction, immediately beneath the integument, are numerous tubes, exceedingly small in size, forming a beautiful *rete*, akin, as is supposed, to the capillary system of the higher order of animals. These tubes have been described as ending in minute *cæca*, and which they would appear here and there to do; but their continuous connection and reticulated arrangement are well seen in flukes rendered transparent by immersion in glycerine. They give passage to a

colourless fluid, among which are numerous granules. These tubes would seem to be chiefly concerned in nutrition, but whether they have or not any direct communication with the true digestive system we have been unable to determine. Indeed, this is a point in connection with the organism of the distoma on which we hesitate to speak with confidence. In the young flukes, referred to at *page* 94, the aquiferous system appeared to be so connected.

In distomata which contain but little bile the aquiferous tubes are seen to advantage, but we have failed to find them united to a single vessel centrally placed, as described by some authorities. We have also been unable to detect the so-called "excreting organ" of Van Beneden, Aubert, and others, which is said to be situated near the caudal extremity of the entozoon, and to receive the contents of this single vessel. Is it possible that the "excreting organ" has been confounded with an occasional dilatation of one of the tubes connected with the external male organ —the *vasa deferentia*—at its inferior extremity? We have often found one, and sometimes both of these tubes to be thus dilated; although in the majority of instances such is not the case.

The readiness with which distomata imbibe tepid water, which causes them to swell out and become very opaque, led us in our original investigations to suppose that these aquiferous tubes might receive their contents by endosmosis, and we had recourse to a variety of experiments with coloured fluids to determine the point. At length we concluded, however, that such was not the case, although we found that distomata placed in *tepid bile* would imbibe some of this fluid, yet by no means so quickly nor in such quantity as they did water.

Ventral Sucker.—Before describing the internal structures of the fluke, we will add a few words in this place on the ventral sucker, a magnified view of which, when detached from the body, is here inserted. See *fig.* 4.

Fig. 4.
Magnified view of the Ventral Sucker.

This organ consists of an outermost raised border, of a circular form, surrounding a concave or sunken centre, which is imper-

forate. The border is very firm compared with the general surface of the body of the distoma, and is chiefly composed of two sets of muscular fibres arranged after the manner of an ordinary sphincter. Muscular fibres also radiate from the centre of the sunken part towards the outer edge of the border. The whole arrangement is beautifully adapted for the attachment of the entozoon to the mucous membrane of the biliary ducts, whereby it is enabled to resist the contraction of the ducts to expel it with the bile into the intestine. Use, no doubt, is also made of this sucker as a kind of focal point in the entozoon's efforts to travel onwards into the smaller branches of the ducts to deposit its ova. Besides this, an opinion prevails that the organ is employed in the act of coition between two distomata, supposing such to be necessary for fructifying their ova. We, however, incline to the opinion that no such contact does take place, but that the entozoon is self-impregnating.

Digestive System.—This part of the organism of the distoma is more simple in its arrangement than many other portions, and although it has been described with much minuteness, several of these accounts are very far from correct. It commences at the bottom of the mouth or oral sucker as a single tube or œsophagus, which runs for a short distance directly downwards, and then divides into two main intestinal branches (see *figs.* 5 and 6). These branches diverge from each other, and in so doing they approach the outer borders of the entozoon. This divergence is greatest opposite to the ventral sucker, after which the tubes again converge a little, and then run in a parallel course towards the caudal extremity, where they split up into numerous fine divisions. Where their divergence is most, there also the tubes are largest, being often pouch-like in their form. Prior to their dilatation, they give off from their outer side four or five smaller branches, which take somewhat an upward course in this the cervical portion of the entozoon and run towards the margin of the creature, dividing in their course in an arborescent manner into numerous fine canals, to end ultimately in minute *cœca* (*fig.* 5).

From below these branches, usually about fifteen others leave each parent trunk, also on the outer side, and take a similar course, dividing and ending in the same manner. These, however, all incline more or less downwards. The parent trunks, thus diminished in size, next split up in the way before described. A few branches—rarely more than five or six—leave the trunks on their inner side, and running a very short distance towards the medium line of the distoma, end likewise in a similar manner. The situation of the intestinal tubes is about central between the dorsal and ventral surfaces of the entozoon, so that they are

visible on either side. The general arrangement of the trunks and branches is very well depicted in the annexed engraving, *fig.* 5.

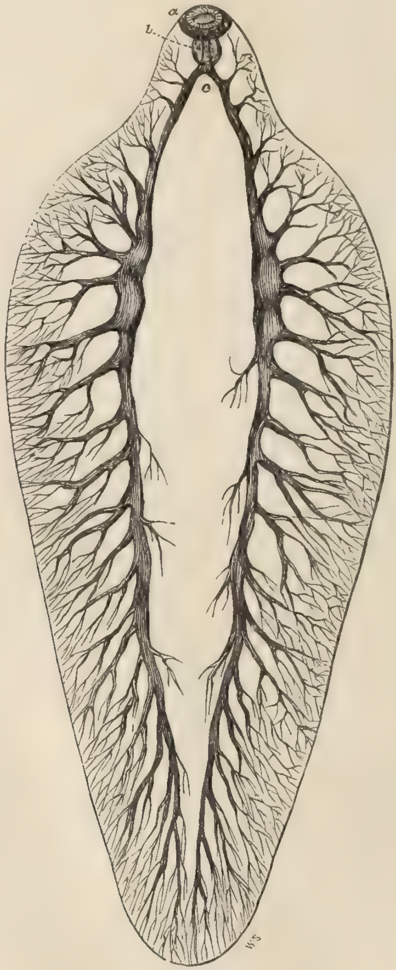

Fig. 5.
Digestive System of the Distoma. Magnified.

In this illustration, and also in the one following (*fig.* 6), *a* marks the oral sucker, *b* the œsophagus, and *c* its division into the two intestinal branches or parent trunks from which the others spring.

In *fig.* 6, inserted overleaf, an attempt has been made to depict the arrangement of the muscular fibres at the origin of

the digestive organs, but not with the success we could have wished.

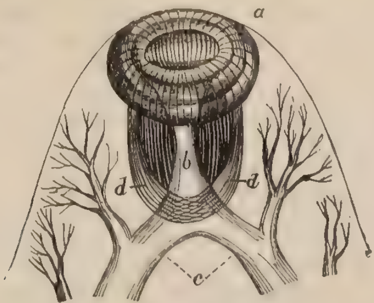

Fig. 6.

Oral Sucker and Œsophagean Sphincter. Highly magnified.

Oral Sucker and Œsophagus.—These parts of the distoma seem not to have received that amount of attention which is necessary to explain the double function they have to perform—namely, of an inlet and outlet to the bile on which the entozoon exists. Examined with a low magnifying power, the oral sucker and œsophagus appear to be continuous as a simple funnel-shaped body, situated immediately above the bifurcation of the digestive tube. They will, however, be found to be far more complex in their arrangement when carefully dissected under the microscope.

The sucker itself (*a*, *fig.* 6) is formed on the same plan as the ventral one, with its raised and rounded border, and sunken centre. Directly at the bottom of the concavity an opening leads to the œsophagus (*b*, *fig.* 6), a short tube represented as slightly dilating inferiorly, where it divides into two principal branches (*c*). From its commencement to its termination the œsophagus is surrounded with bundles of muscular fibres (*dd*). These fibres run lengthways by the side of the tube, reaching from its upper to its lower part, and so embracing it as to form an elongated sphincter. The artist, by intersecting lines at the lower part of the œsophagus, has attempted to show that the fibres surround the canal, and with the object also of bringing it into view, he has represented a portion of the sphincter as being cut away in front. Although the œsophagus lies in the centre of the muscular fibres, these are not equally developed all around it, but are stronger on the lateral parts than on the back or front.

Early after commencing the study of the anatomy of the liver-fluke—now several years since—we had an opportunity of seeing the entozoon eject from its oral opening considerable portions of the contents of the digestive tubes. We first witnessed this on placing one, obtained directly after slaughtering a sheep, in some

tepid water. The creature almost immediately elevated its head, and, with a leech-like action, ejected a portion of the contents. This was quickly followed by two other similar ejections, soon after which it died. Since that time we have witnessed the same thing again and again, for it has always been our object to obtain the entozoon alive for our investigations and dissections.

That a strong œsophagean sphincter is required can be easily understood, when it is remembered that on the creature having forced itself into the smaller ramifications of the biliary ducts, the pressure exerted on its body by the peristaltic action of the ducts is at times very considerable. This pressure might otherwise drive out the alimentary matter from the digestive organs. In dead flukes the sphincter is still so firmly closed that, although by pressure between two plates of glass under the microscope, the alimentary materials are easily driven backwards and forwards and made to press against the lower part of the œsophagus, none can be seen to be expelled through it into the mouth. The free passage of the contents of the digestive organs in either direction shows, however, that every facility is given for the oral sucker to act either as an inlet or outlet to the digestive system.

Generative Organs.—The reproductive system is without doubt by far the most interesting portion of the organization of the distoma, but at the same time it is the most complex in its arrangement, and difficult of investigation. This arises from the circumstance that the entozoon is hermaphroditic or bi-sexile, and as a necessary consequence the male and female organs are intermingled to some extent, while their naturally large development requires their occupancy of a considerable portion of the body of the creature. In the illustration (*fig.* 7) inserted overleaf, the generative organs are represented apart from any others—an arrangement which will materially assist our description. We shall first explain the several peculiarities of the female organs, and follow with those of the male.

Female Organs: the Vitelligenes, or yelk-forming organs (*a a*, *fig.* 7). These structures occupy the margins of the body on either side, extending from about opposite the inferior portion of the ventral sucker to the extreme end of the distoma. The yelk sacs are clustered around minute tubes in the form of branches, somewhat like currants upon their footstalks, giving a beautiful dendritic character to the whole arrangement. The stems of these tubes are in turn connected with two larger ducts, *b b*, which run more or less in a wavy course parallel with the margins of the entozoon. These collect the contents of the smaller tubes, which they transmit by two horizontal branches, *c c*, to an ovoid body situated in the centre of the creature at about its upper third.

This body has been by some helminthologists called the "*germ stock.*" In some specimens of distoma in our collection a third branch is seen to proceed from the yelk sacs towards the "germ stock," joining the main horizontal duct before it reaches that body.

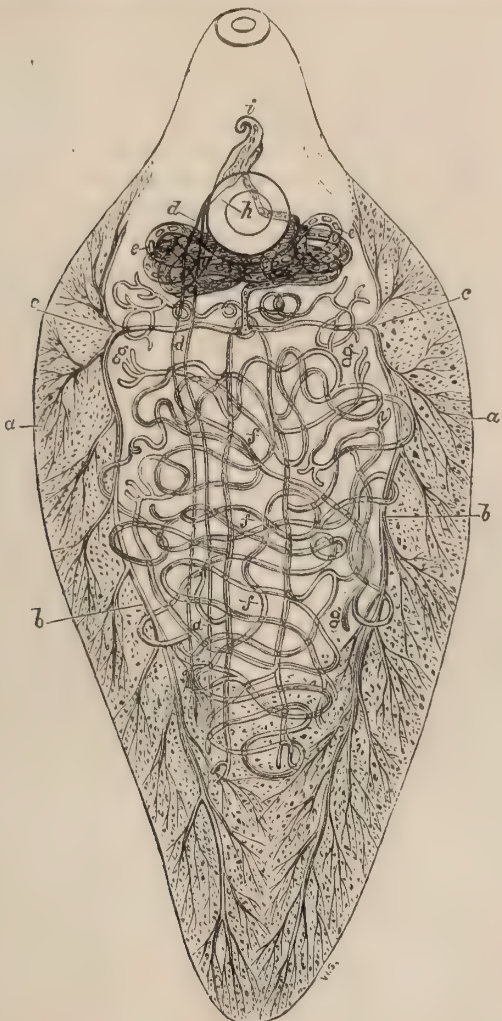

Fig. 7.

Generative Organs of the Distoma. Magnified.

From the "germ stock" a short duct arises which leads directly upwards into the uterus, *e e.* Within this duct the ova are first to be detected—a fact which we think of some import-

ance in determining the use of the "germ stock," about which authorities differ. The eggs are colourless before they reach the uterus, and have exceedingly thin cases or coverings.

The uterus.—This organ lies nearer to the ventral than the dorsal surface, and is therefore best to be observed on that side. It stretches more or less across the body of the entozoon both beneath and behind the ventral sucker. It is liable, however, to great variation in size—according to the quantity of ova it contains. In some instances the ova lie in many parts of the organ as a single file, while in others they are crowded together and overlie each other in all possible directions, so as to have an appearance of being placed in a largely dilated cavity, rather than in a duct coiled and turned upon itself. From the uterus the *oviduct* (*f*, *fig.* 8, *page* 108) passes in a tortuous course by the side of, or occasionally partly behind, the ventral sucker, to reach the sheath of the male organ (*i*, *fig.* 7, and *d*, *fig.* 8), upon the edge of which it opens. This opening is with very great difficulty to be detected, and we have spent many a fruitless hour in searching for it, only succeeding now and then.

The ova lie always along the *oviduct* in a single row (see *f*, *fig.* 8), and this entirely without reference to their number within the uterus. They therefore escape singly, but no doubt with very quick succession, so that a considerable quantity are soon voided. While in the uterus the ova undergo a singular change in colour by their shells losing their original white condition and becoming of a yellowish-brown hue. The shells also become harder and thicker, as would appear from an earthy deposition within them, for when the ova are slightly pressed on a slip of glass they are found to have a gritty feel, and to give a peculiar crepitating sound. The origin of this hardness is to our minds somewhat doubtful, although we would not dispute that it may be due to the secretory function of the internal membrane of the uterus. It is sufficient in this place to allude to the circumstance, more especially as we shall presently return to it again.

Male Organs: the Testes.—These organs occupy the central parts of the body, being bounded inferiorly and laterally by the yelk sacs and ducts, and superiorly by the uterus. They consist of a series of convoluted tubes, which seemingly follow no fixed plan of arrangement (see *f f*, *fig.* 7), being entwined and twisted in every possible direction. In many places they would appear to have cœcal beginnings, which are more or less forked and branched (*g g*, *fig.* 7). In size they exceed the ducts belonging to the female generative system, while their contents impart to them a much paler colour. Some of these seminiferous tubes cluster around the "*germ stock*," and have, we believe, a free communi-

cation with it; if so, we see no reason to doubt that it is here that impregnation takes place, and that the whole of the spermatic fluid finds in this place its proper outlet.

We are aware that a different opinion prevails among helminthologists, some of whom, however, speak doubtfully on the point; and we are also not unmindful that our statement assigns no function to the so-called "*vasa deferentia*" and generative appendage, or "*intromittent organ*" (*i*, *fig.* 7, and *a*, *fig.* 8) in the *fœcundating* process. One fact among several others which points to this conclusion is that the ova are seen *covered with their membranous cases* when issuing from the "germ stock," to enter the uterus (*see description of these parts, preceding page*).

Now it is evident that before being so covered their impregnation must have been effected. But supposing, on the contrary, the fœcundating fluid of the male organs to be ejected into the mouth of the oviduct, by being first conveyed, through the action of the "*vasa deferentia*," into the receptacle (*b*, *fig.* 8), which lies in the sheath (*d*, *fig.* 8) of the supposed intromittent organ, it is evident that it must traverse the entire convolutions of the uterus, pass all the perfected ova, and descend into the "germ stock" to exert its special purpose. This, at any rate, is a circuitous course, although none the less possible merely on that account. The other view, however, has simplicity if not positive verity for its support; it leaves, nevertheless, an office to be assigned for the so-called "*vasa deferentia*" and the other organs connected with them, of an entirely different character, unless absolute copulation between two distomata does take place.

We speak with some hesitation and with much deference to eminent helminthologists, when we say that the "*vasa deferentia*" (*d d*, *fig.* 7, and *c c*, *fig.* 8), which have their origin near to the *caudal extremity* of the entozoon, may possibly secrete a fluid which is carried into the receptacle (*b*, *fig.* 8), lying within the sheath of the generative appendage, hence to be conducted into the oviduct during the well-known retraction of the organ, to furnish the earthy materials necessary for the proper formation of the shells of the numerous ova existing within the uterus. From the peculiar arrangement of the parts it seems easy for the opening of the duct belonging to the appendage to be brought in contact with the mouth of the oviduct, when the organ is partially retracted into its sheath, and it is probable that in the act of retraction the materials are made to enter. That there must be a great demand for such matter all must admit who have carefully studied the ova of the *Distoma*. Such a view, of course, presupposes that the *vasa deferentia* are unconnected with the testes, which, by-the-bye, far exceed them in size; not that this fact of itself negatives the opinions which are generally entertained,

but in considering the function of these intricate organs it should not be lost sight of.

Fig. 8, here inserted, will, from the large scale on which it is drawn, materially assist the general description of the generative organs which we have given. It will also help to convey a correct idea of the formation of the "*intromittent organ*" (*a*), when exserted.

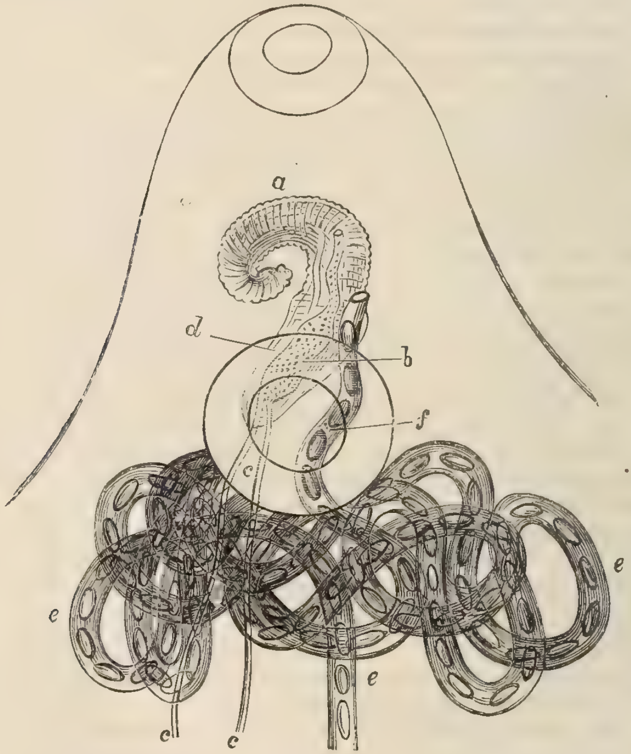

Fig. 8.

Highly-magnified view of the Uterus and Oviduct of the *Distoma hepaticum*, with the so-called Male Intromittent Organ, Seminal Receptacle, and Ducts.

The intromittent organ, or generative appendage. — Up to the present we have not met with any correct representation of this organ; we can, however, recommend the one here given (*fig.* 8) to the favourable notice of the reader. The illustration, together with most of the others which we have employed, is original, and we have preferred for each of them to represent special portions of the structure of this interesting and somewhat complicated entozoon, rather than to adopt the confused plan of

mixing the whole up together in one illustration. The generative appendage is strongly muscular, especially on the side of its curvature, as is attempted to be depicted by the lines there drawn. In addition to its longitudinal order of fibres, it has also a circular set, which are well developed. When fully pressed out the appendage curves upon itself, and always in proportion to the amount of pressure which is employed to produce its exsertion. It is also found to have a cauliflower-like projection at its extreme end, which otherwise is of a rounded form. It is imperforate at its extremity, for the duct which enters its base from the receptacle (*b*) within its sheath only extends about a third part of the entire length of the appendage, where it abruptly terminates.

It has been supposed, but erroneously, that a canal runs through the whole course of the organ, and in several illustrations of it such a passage is represented. We quote Professor Owen's remark on this point, which must suffice to show the general opinion of naturalists : "This appendage," says this distinguished professor, "is spirally disposed when flaccid, is tubular and distinctly perforated at the apex." *

The extraordinary curving of the appendage upon itself when completely exserted, and therefore under circumstances analogous to its erection, seems to us to militate greatly against the opinion of its being used as an *intromittent* organ, in the true sense of the term ; whilst its size likewise negatives the idea that it can be made to enter the mouth of the oviduct as it would have to do in ordinary copulation. If contact for fructifying the ova does take place between two distomata, but which we very much doubt, it would appear that the generative appendage of one could only enter the *sulcus* which is produced by the retraction of the organ into its sheath in the other of the two creatures thus engaged. In being fully retracted, however, the appendage appears to simply lie within the sheath ; and it is very probable that its retraction is chiefly needed for the purpose of giving a facility to the escape of the ova from the oviduct, as previously explained.

Nervous system.—In concluding our description of the anatomy of the distoma we add one word respecting its *nervous system.* Mehlis, some years since, described the nervous system of the entozoon as consisting of "a delicate œsophageal filamentary ring, with a slight ganglionic enlargement on each side, from which minute fibres pass into the suctorial sphincter ; and two large filaments pass backwards, one on each side, as far as the ventral sucker" (*Owen*). We are free to confess that up to this time our investigations have not satisfied us of the existence of a

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* 'Lectures on Invertebrate Animals.'

nervous system, but we certainly see no reason to doubt Mehlis' description, and therefore cannot say with Küchenmeister that it "is wanting."

Having now explained the general structure of the entozoon as fully as present circumstances seem to require, we pass on to speak of its natural history and development.*

Natural History of the Distoma hepaticum.

The Distoma belongs to that class of creatures which, although parasitic to mammalian animals, are only so in their highest stage of development. To reach this they undergo a series of successive metamorphoses, out of the body of the animal which they ultimately inhabit. The liver-fluke, while passing through some of its transformations, is met with in rivulets, ponds, stagnant waters, wet pastures, and allied situations—a circumstance which explains many of the facts practically known to agriculturists and others respecting the rot in sheep.

Notwithstanding the rapid advances made by science within the last few years in unravelling many of the singular metamorphoses of entozoa, our description of those through which the *Distoma hepaticum* really passes from the *ovum to the perfect entozoon* must be somewhat incomplete, because all of them have not as yet been fully traced out. A far greater difficulty than might be supposed belongs to investigations of this kind, and the time and patience required for the purpose are immense. This difficulty is not a little increased by the circumstance that when many of these forms are existing in water as infusoria we fail to identify them with the particular entozoon to which they belong. Upon the correct solution of the problem, however, hangs our chief hope of affording security to animals against those entozoa which undergo such transformations.

The family of flukes alone is a very numerous one, and has been estimated by some naturalists at from four to five hundred, all of which are thought to pass through allied metamorphoses. As *flukes* they are parasitic to mammals, birds, fishes, reptiles, and even non-vertebrate creatures. With facts like these to grapple with, the only wonder is that so much is really known about the *Distoma hepaticum*, and that helminthologists are enabled to speak with confidence upon some of the transformations it undergoes; and not only so, but to give practical effect to this knowledge by advising flockmasters how to protect their sheep in a great measure from its attacks.

* While these pages were passing through the press our attention was directed to a very excellent paper on the anatomy of the *Distoma hepaticum*, in the 'Intellectual Observer,' by Dr. T. Spencer Cobbold, Lecturer on Comparative Anatomy at the Middlesex Hospital, who, we are glad to see, agrees in very many particulars with ourselves.

Ova.—Sufficient has elsewhere been said to show that the number of ova yielded even by one fluke exceeds any estimate the mind is capable of forming. Examined microscopically the ova are of themselves very interesting objects, apart from any knowledge we may have of their destination. The annexed illustration (*fig.* 9) very faithfully depicts their appearance when

Fig. 9.

Ova of the Liver-fluke, showing the manner of the escape of their contents by the detachment of the Opercula. Magnified.

viewed in the field of the microscope. It not only represents their form, but shows the nature of their contents, and the manner in which these make their escape. Their size is liable to slight modification, some being rather larger than others. Many measure about $\frac{1}{180}$ of an inch long, and $\frac{1}{300}$ of an inch broad. To the unassisted vision each egg, however, may be made distinctly visible, by putting a number in a small phial filled with water, agitating this, and then watching their fall while holding it to the light. Their being rendered so perceptible by this procedure is doubtless due in part to their brown colour.

The density of the shells of the ova is probably an important means for enabling them to resist decomposition, and to retain their vitality for a much longer period than otherwise would be the case. How long their vital power may continue it is impossible even to conjecture. We have kept ova well covered with water for upwards of two years, exposed during the whole time to the air by leaving the cork out of the bottle, without observing any very great change in the larger part of them. Nothing at all approaching to decomposition could even then be detected, but whether all had retained their vitality could not be determined. That some, however, had done so, is evident from the result of the experiment.

The experiment was begun in January, 1853, simultaneously with another, hereafter to be described, and was continued to April, 1855. On September 28, 1853, here and there an ovum was observed to have parted with its operculum, and a few circular, *nucleated* cells were to be detected set free in the fluid, of somewhat larger size, but otherwise identical with those seen in the interior of many of the ova. They had a tremulous motion, which was interrupted now and then by a jerking action

—thereby giving evidence of their being ciliated bodies; but the object-glasses then at our command were insufficient in magnifying power to bring the cilia into view. After this time, more and more of the ova parted with their opercula, always with a proportionate increase in the number of circular-shaped embryos. Judging from the developing process as seen to be going on in the interior of an ovum from the first gathering together of the yelk to the formation of cells, we reckoned that five or six embryos were yielded by each ovum.

In a short time numerous infusoria—polygastric monads—existed in the fluid, which were slow in their movements, devoid of colour, and in some other respects very similar to the *Monas enchelis* of Pritchard; but whether these were produced by an elongation of the original circular-shaped embryos of the fluke into the ovoid form of the monad, we could not satisfactorily determine. Throughout the entire year of 1854 a gradual increase of detached opercula took place, but at its close, and even down to April 15, 1855, when our observations were discontinued, a very large number of ova were as perfect in appearance as when originally placed in the water. Circular-shaped embryos, and flattened, flask-shaped monads were still abundant, but no higher form of animal life could be detected.

We have given the particulars of this experiment, because we consider that everything which tends to create thought is of the first importance in studying the history of the liver-fluke, and of material use in helping us to explain many of the phenomena connected with an outbreak of rot.

Several analogous instances of the long preservation of the germs of future creatures within the egg can be adduced. Küchenmeister, in describing the treatment for *Ascarides*, says: "The first thing to be done by the surgeon in practice consists in the destroying the eggs of the *Ascarides* whenever he meets with them, and exterminating every female that he can get at. It was H. E. Richter's merit that he first ascertained that the eggs remain uninjured in sewage, &c. Recently Barry, Bischoff, and others have proved that the process of segmentation of the eggs of *Nematoida* continues even in very concentrated alkalies or salts. According to the experiments of Verloren and Richter, already described, the eggs of *Ascarides* only attain their full maturity when free in nature (in water), and only undergo the process of segmentation in this situation. In the various species of *Ascarides* the time necessary for this purpose may be different; for whilst, according to Verloren, this is completed in one species of *Ascaris* within a few weeks, the eggs of the *Ascaris lumbricoides* require at least eleven to twelve months for the purpose. Even Richter's first statement spoke of such a period: according to a

communication from him in January, 1857, embryos had then begun to be formed in eggs which had been put into water by him in February, 1856, but they did not move."*

We have a similar experiment with the eggs of the *Ascaris lumbricoides* of the horse, now in the process of completion. They have been lying in water for several months, but without any evidence of the development of embryos. Hereafter we may find occasion to give the result of this experiment, together with others which we have adopted to elucidate the natural history of some of the entozoa.

It is difficult to say under what circumstances the embryos of the future distomata will be most quickly matured, so as to escape from the ova. The nearer, however, all experiments to determine this point are made to approximate the natural order of things, the greater will be their value. In exposition of this subject we come now to the experiment previously alluded to, which was begun on January 17, 1853. Reflection led us to adopt the following plan for keeping the ova *damp only*, while they were being freely exposed to the atmosphere—imitating in this respect their location on a wet pasture. Two or three layers of bibulous paper were floated on the top of water in an ordinary soup-plate, and upon these were sprinkled some ova obtained fresh from the biliary ducts of a rotten sheep. They were carefully examined day by day, and after a short time it was evident that the developing process was quickly going on in the interior of many of them.

On the 1st of March we detected, for the first time, some of the ova without opercula, and a number of free nucleated cells (embryos) identical with those previously described. By the 10th of the month more ova had parted with their opercula, and the number of embryos had consequently increased. Polygastric monads of the form previously described also made their appearance, and, we were inclined to think, bore a proportion to the original liberated embryos. It is probable, however, that they had no connection with each other. Matters thus continued throughout the month, and into May, but without any variation of sufficient importance for the further continuance of the experiment. By far the greater part of the ova were at this time as perfect in their form as when originally placed upon the wetted paper.

All helminthologists of repute appear to agree with reference to the nature of the embryos yielded by the fluke-egg, but, from the difficulties of following the changes which subsequently occur,

* 'Animal and Vegetable Parasites.' Translated by Dr. Lankester. London, 1847.

conjecture to some extent takes the place of observation Judging, however, from analogy with regard to the development of other *Trematoda*, there appears no reason to doubt that the ciliated embryo of the *Distoma hepaticum* does not undergo any material change until becoming parasitic to water-snails, slugs, &c., and that when thus located it becomes converted into a peculiar organism called a *Cercaria*-sac (see *fig.* 10, *page* 115). From the nucleus of the distoma-embryo development goes on, and a brood of young *Cercariæ* are ultimately formed within the sac, by a species of successive budding, each one in turn thus becoming a parent. From the first, second, or third of these offspring a return to the form of the original parent distoma takes place.

This system of propagation has been described most accurately by Steenstrup, who has named it " *Alternation of Generation*," as differing materially from ordinary metamorphoses. We give his own definition of the process : " Alternation of Generation is," he says, " the remarkable phenomenon of an animal producing an offspring which at no time resembles its parent, but which, on the other hand, itself brings forth a progeny which returns in its form and nature to the parent animal ; so that the maternal animal does not meet with its resemblance in its own brood, but in its descendants of the second, third, or fourth degree of generation." *

Many examples of this system of propagation take place in nature, and among creatures far higher in the scale of organisation than those of which we are now speaking ; but it is unnecessary, in a treatise of this kind, that these should be furnished. We may, however, direct the reader seeking such information to Steenstrup's work, and also to Professor Owen's on *Parthenogenesis*, Küchenmeister's on *Parasites*, † and Von Siebold's on *Cystic Worms*. ‡

The *Cercariæ*, so called from their caudate form (see *fig.* 12 *page* 116), were for a long time considered as *Infusoria* when found to be floating freely in water, their origin and mode of propagation being unknown until the discovery of Steenstrup. The *cercaria*-sacs were designated by him "*nurses*," and the young *cercariæ* developed within them "*parent-nurses*"—terms which have helped rather to mystify the matter than to render it plain. Most *cercaria*-sacs are of simple organisation ; but, notwithstanding this, they are found of various forms, according to the kind of *cercariæ* to be developed within them.

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* 'Alternation of Generations,' by J. Japetus Sm. Steenstrup, translated from the German by George Busk. London, 1845.

† Translated by Dr. Lankester. ‡ Translated by Professor Huxley.

In the accompanying illustration (*fig.* 10) we have represented the sac of the *Cercaria ephemera*, copied from Huxley's translation of Von Siebold's work. In it *a* represents the oral

Fig. 10.
Cercaria-sac, showing the formation of Cercariæ. After Huxley.

cavity of the cyst; *b*, the alimentary canal; *c*, a developed *cercaria;* and *d*, other *cercariæ* in the course of formation. In his description of these organisms Von Siebold remarks that "the whole of these multifariously-shaped *cercaria*-sacs enclose within the walls of their bodies a cavity which, besides the intestinal cœcum (where such a structure exists), contains nothing but young *cercariæ.* These young are developed, not from *ova*, but from *gemmæ*, which differ essentially from ova. They are solid, round, and somewhat flattened discs, which, growing and developing, become little caudate worms, resembling in form and organisation certain Trematoda (*Distoma*, *Monastoma*, &c.).

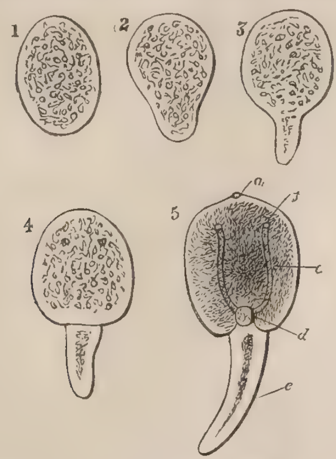

Fig. 11.
Magnified view of the development of Cercariæ. After Huxley.

Fig. 11 represents on a large scale the development of the *cercariæ* as it goes on within the sac from the first bud or sporule to the perfect embryo. A reference to the figures will show—1, a sporule ; 2, sporule elongating ; 3, sporule becoming caudated ; 4, early form of *cercaria ;* and 5, perfect embryo. In the last-named figure, *a* indicates the oral aperture ; *c*, *d*, the urinary organ ; *e*, the tail ; and *f*, two pigment-spots.

When first set free from the sac the *cercaria* is rather tardy in its action, but after a time it swims freely about, assisted in its various movements by the length of its tail. *Fig.* 12, which we

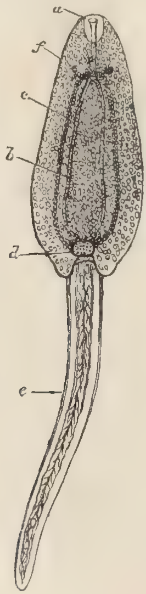

Fig. 12.

A fully developed *Cercaria ephemera.* After Huxley.

here insert, shows a fully developed *Cercaria ephemera*, the body of which, it will be noticed, bears a strong resemblance to a fluke. In this figure, *a* represents the mouth ; *b,* the alimentary canal ; *c*, *d*, the urinary organ ; *e*, the tail ; and *f*, pigment-spots. It is worthy of note that in the most perfected *cercariæ* no sexual organs can be detected, although in other respects their resemblance to distomata is so complete. It is evident from this that they have to undergo a higher form of development, which they can only attain by becoming entozoic to other creatures. Some varieties of them have been observed to

bore their way into water-snails, to cast off their tails, and *develope into flukes* with perfect sexual organs—thus completing the series of changes. After entering the body of the snail, and before being transformed into the fluke, the *cercaria* rolls itself into a little ball and passes into the *pupa* state, by emitting from the surface of its body a mucous secretion which hardens and encloses it. This change was first observed by Nitzsch, and afterwards by Siebold and others. The annexed engraving (*fig.* 13) represents the *pupa* state of the *Cercaria ephemera*. The letters point—*a*, to the oral sucker, and *c*, *d*, to the urinary organ.

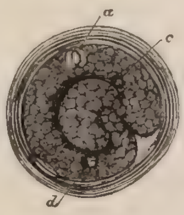

Fig. 13.
Encysted *Cercaria ephemera*. After Huxley.

Encysted *cercariæ*, besides adhering in large numbers to a great variety of *mollusca*, the larvæ of aquatic insects, &c., are likewise found free in water. How long their *pupa* state may continue is not known, but, according to the experience of Steenstrup, in some varieties of *cercaria* it does so "for many months."

Thus it has been proved that the *pupa* state of the *cercaria* is the *penultimate* form of the fluke, and it is probable that in this state the entozoon enters the organism of vertebrate animals as well as others. Küchenmeister states that "when De la Valette set about administering the tailed, free living forms—that is to say, the *cercariæ*—the result of a metamorphosis of these forms into mature distomata did not occur. He then directed his attention to the forms originating from the *cercariæ* just referred to, which are enclosed in cysts, and, although still asexual, are already in other respects somewhat further developed . . . . When administered in this state the young distomata are quickly provided with germ stock, testes, and ovaries. . . . . According to De la Valette's experiments, it is certain that the *Cercaria echinifera* is converted very rapidly in the intestine of warm-blooded animals, and slowly in cold-blooded species, into *Distoma echinifera*, Val.; that *Cercaria flava* of the *ephemera* becomes transformed into *Monostomum flavum* of the finches and sparrows; and that *Cercaria echinata* is converted into *Distoma echinata Anatis Boschadis* (Zeder)."

Although the transformation of *encysted cercariæ* into *distomata*

hepatica of the sheep and other mammalia has not as yet been fully ascertained, we see no reason to doubt that they follow the law of development belonging to flukes in general. Until, therefore, direct experiments shall have shown to the contrary, we shall continue to hold the opinion that the several metamorphoses of all the distomata are regulated by the same laws. Sheep, we believe in common with mammalian animals in general, receive the *cercariæ* in their *pupa* state, and not as free living forms. If the contrary were the case, it is evident that the *cercariæ* would have to undergo their *pupa* change within the digestive organs, and, judging from analogy, they would have as free *cercariæ* to first imbed themselves in the mucous membrane for this purpose. We do not regard this as being at all probable; besides which, we have seen that in De la Valette's experiment of administering free *cercariæ* to warm-blooded animals, he failed in producing distomata, and only succeeded when he gave them in their *pupa* condition.

Although distomata are so widely diffused, it is an established fact that ruminating animals are more frequently affected with them than others, and sheep most of all. We have directed attention to the latter-named circumstance in treating of the causes of rot, and have there said that the probable explanation of it was that the natural habits of the sheep led to its cropping the short grasses and feeding near to the ground, where the penultimate forms of distomata abound. The greater susceptibility, however, of ruminating animals would seem to depend on other causes, and to be rightly accounted for by reference to the special functions of their digestive organs. Encysted *cercariæ* received with the food of ruminants are not at once exposed to the solvent action of the gastric juice, but are detained for an indefinite length of time within the rumen and the other preparatory stomachs whose secretion is non-digestive. Within these organs, therefore, no special cause of destruction to the vitality of the *cercariæ* exists, and hence a greater number of distomata are perfected, ultimately to find their way into the bile-ducts by passing firstly into the true digestive stomach and onwards into the duodenum. The converse is the case with regard to the simple-stomached herbivora and other mammals, viz., that the encysted *cercariæ*, on entering the digestive system, are immediately exposed to the action of the gastric juice, by which many of them are doubtless destroyed, and consequently do not reach their proper habitat—the liver.

This circumstance may account in part for the well-known fact that horses graze almost with impunity on pastures where both oxen and sheep become affected with flukes. Other causes, without doubt, influence this immunity; among which must be placed the general plan adopted in rearing horses, which, together

with much of their food even when they are young, contrasts greatly with the feeding and arrangement had recourse to in the bringing up of cattle or sheep. Later on in life the uses to which horses are put likewise prevent to a great extent their reception of the penultimate forms of the fluke. Nevertheless, distomata have now and then been found in the horse and also in the ass, and they were so by Daubenton. The late Professor Sewell, of the Royal Veterinary College, likewise discovered some flukes in the ass, specimens of which are preserved in the College Museum. In addition to these examples, it may be mentioned that we were recently consulted by Mr. Pritchard, M.R.C.V.S., Wolverhampton, respecting a case communicated to him of flukes in the liver of a horse. Elsewhere we have spoken of the susceptibility of the pig and also of the hare and rabbit to flukes; so that the instances of simple-stomached animals being affected are not so unfrequent as might have been inferred from the formation and office of their digestive organs.

In herbivora of such large size as the horse and ox, the ill effects of the entozoa are not so marked as in the sheep and smaller animals. Besides which, their number is generally limited, few existing as a rule. Dr. Budd has justly observed in his work '*On Diseases of the Liver*,' 1857, that "the supposition that the distomata cause, in some way or other, a serous discharge from the gall-ducts they inhabit, accounts for their producing less effect on larger cattle than on sheep, hares, and rabbits. A loss of albumen that would exhaust these small animals would have little effect on an ox."

According to Küchenmeister, the entozoon has likewise been found in man by several persons, among whom he names Malpighi, Chabert, Biddloo, Pallas, Brera, Mehlis, and some others. In our own country similar cases of their existence are recorded by Mr. Busk, F.R.S., and Professor Partridge, of King's College. Mr. Busk took fourteen specimens of the variety called the *Distoma crassum* from the liver of a Lascar, one of which is preserved in the museum of the Royal College of Surgeons. The particulars of Mr. Partridge's case are narrated in Dr. Budd's work on the Liver, previously referred to.

In addition to these cases, distomata have also been discovered under circumstances which, although very remarkable, are good evidences that the entozoon can be matured within the external tissues of warm-blooded animals, as in those of the cold-blooded. Thus it is recorded that Giesker, of Zurich, took one from the sole of the foot of a woman, the wife of an overseer of a silk-factory near to that town, which it is supposed had embedded itself in the skin as a *cercaria* while she was engaged in "washing linen in the more stagnant parts of the Lake of

Zurich." Mr. Fox, of Topsham, Devonshire, also found one beneath the skin a little behind the ear of a sailor, which apparently in no way differed from the ordinary liver-fluke. Rightly considered, these cases tend to prove that the natural history of the liver-fluke is identical with that of others of the class.

To pass from these exceptional cases of development of flukes again to those of the sheep, we would repeat that the two causes which render this animal so remarkably susceptible to the entozoon, are its natural habit of feeding close to the ground and its being a ruminating animal. In the production, however, of rot, external causes are the chief in operation; these being an elevated temperature combined with excess of moisture. Under these circumstances myriads of *cercariæ*, which would otherwise perish, are brought to perfection, abounding wherever the ova of flukes may have been conveyed. Lands liable to flood are therefore the most dangerous, as the overflowing of rivers and brooks brings upon them these infusorial creatures in countless numbers. The danger increases in proportion as the soil of such land is of a tenacious character, and especially if the water accumulates in places and becomes stagnant. Nor can we wonder at any land of ordinary elevation, if retentive of moisture, springy, and undrained, being "liable to give the rot."

No limit can be put to the liabilities of the presence of *cercariæ*, where excess of moisture abounds. They may be conveyed in some of their metamorphoses, and in forms more or less active, by innumerable means, some of which would be scarcely suspected. In considering these causes, the long duration of the vital principle in the ova of the liver-fluke, of which notable examples have been given, must not be lost sight of, nor must the fact of the millions of ova which are constantly being cast from out of the intestines of rotten sheep and other animals, in all conceivable situations and under every variety of circumstance.

The more we reflect on the true cause of rot and on the facts connected with its appearance, and endeavour to interpret these by our knowledge of the natural history of the liver-fluke, the more easy of comprehension and simple does the whole subject become, till at last we see no ambiguity whatever belonging to it. In the course of these pages many proofs are given of the correctness of this position; but, as we are unwilling to multiply these without sufficient reason, we shall pass on to record, in the next place, several instances of the quick contamination of sheep with this disease.

Quick Contamination.

The attention which has been given by practical observers to the several circumstances under which rot shows itself, long since

proved that the disease could be quickly engendered. Many such instances are recorded, some of which we purpose to give *in extenso*, as thereby we conceive additional confirmation will be afforded of the correctness of the statement that rot is an entozoic disease.

As early as 1636, allusion is made to the subject by Crawshey, who remarks, that "many shepherds say that, if the weather be hot, their sheep will take the rot in twenty-four hours." * Similar statements are made in general terms by many authors subsequent to this date; but the first special cases which are given in detail, that we have as yet seen, occur in Dr. Harrison's work, 1804. He asserts that the grandfather of a Mr. Harrison, then residing at Fisherton, near Lincoln, "removed ninety sheep from a considerable distance to his own residence. On coming near to a bridge which is thrown over the Barlings river, one of the drove fell into a ditch and fractured its fore leg. The shepherd immediately took it in his arms to a neighbouring house and replaced the limb. During this time, which did not occupy more than an hour, the remainder were left to graze in the ditches and lane. The flock was driven home, and in a *month afterwards* the other sheep joined its companions. The shepherd *soon* discovered that all had contracted the rot, except the lame sheep; and as they were never separated upon any other occasion, it is reasonable to conclude that the disorder was acquired by feeding in the road and ditches."

Again, "A Lincolnshire farmer purchased some turnips in Nottinghamshire, upon which he intended to winter a flock of sheep. The first division, consisting of about forty, were detained one night at a village near to the place formerly alluded to, by the overflowing of the Barlings Eau, and were put upon a piece of flat land which leads to the river. The water had not returned to its former channel more than a day or two. *Every one of the forty became rotten*, whereas the other division, which stopped nowhere by the way, escaped the disorder, and remained well." Harrison further adds, "I have likewise been informed by Mr. David Wright, that a few years since, as a drove of sheep were passing through a long lane in the parish of Irby, one of them, being weary, fell down in the middle of the road. The others were permitted to range at large till their companion was able to travel. They were then driven altogether into a pasture, and it was soon discovered that only the tired sheep had escaped the rot."

We select two more cases of a similar kind, one from Parkinson, 1810, and the other from Youatt, 1837. The former writer

* See page 72.

states that "a farmer in the neighbourhood of Wragby took twenty shearing wethers to a fair in that town, leaving six behind in the pasture where they had been summered. The score sent to the fair, not being sold, were driven back and put into the same field where the six had been left. In the course of the winter every one of these died of the rot; but the six that had been left behind all lived and did well."

The case narrated by the latter-named author is as follows:— "A farmer in Norfolk bought a lot of sheep at a fair warranted sound. The greater part of them died of rot in the course of the winter. The purchaser brought his action for the recovery of the money paid for them. The defendant satisfactorily proved that he never had had a rotten sheep on that part of the farm on which these were bred and grazed. A considerable sum was spent in litigation, when at length it was discovered that the night before the sale—the whole town and its neighbouring pastures being occupied—the sheep were turned into a field in a neighbouring village, and which field bore a suspicious character with regard to this disease. There was then little doubt on the mind of either party that the mischief had been done on that night."

Although it may be unnecessary to multiply cases, still justice requires that we should place on record two more of a similar kind which have been furnished by a well-known agriculturist, Mr. Edward Umbers, of Wappenbury, Warwick. Mr. Umbers writes thus:—

"In the first place, I will relate a circumstance that occurred to my father (the late Mr. W. Umbers), who was an eminent breeder of Leicester sheep. At his first outset as a breeder he went into Leicestershire and purchased twenty ewes, and sent them to a ram belonging to another breeder in the same county. In due course my father received a letter stating that the ewes were ready to come back, and requesting him to send for them; the writer added that one ewe was lame, and would require a horse and cart for her removal. Accordingly, a careful man with a horse and cart was sent for the ewes, and all were brought home safely.

"In *eleven weeks and three days* after their arrival at home the shepherd came to my father saying, 'One of the bought ewes is dead.' This was a source of great disappointment, and when she came to be examined she proved to be rotten. My father at once wrote to the person of whom he purchased the ewes—they having been warranted sound—stating what had occurred. The gentleman, in reply, invited my father to his house to make every inquiry, he never having had a rotten sheep on his farm. My father went over and found to his entire satisfaction that the ewes were not rotted while there. He then proceeded to the farm where the ewes were put to the ram, and was equally satisfied they had not received the disease there. He then traced the sheep on their way home to a field where they remained for the night, the lame sheep being unloaded and lying in the field with the rest: there also he was perfectly satisfied from the most minute inquiries the rot had never been known. Still tracing the sheep homewards, he came to a pothouse by the roadside, where the man had gone in to have his dinner, leaving the nineteen

ewes in the road and the lame ewe in the cart; here was found to be a most rotting district. The result was that the whole of the nineteen died *rotten* before lambing-time, and the ewe in the cart lived for years and bred and did well.

"The second case I would mention occurred to a very intimate friend and neighbour of mine who placed his 'tegs' (viz. young sheep of the first year) on a piece of seeds adjoining a meadow by the river Leam, which in wet seasons is sure to give the rot. Such was the case in the year in question. Some trees had been felled between the seeds and the meadow, and, the gaps in the hedge not having been properly made up, the shepherd was sent after harvest to stop them. Having done a part of them he went home to his dinner, and to his surprise when he returned he found all the tegs in the meadow. He put them out immediately, and they never got in afterwards, and no one on the farm had ever seen them in before; but the consequence was, that the whole of the tegs were rotted, and most of them died before the next shear-day, and those poor wretched creatures which remained to that period cast off their wool and subsequently dwindled away and died. This farm is a perfectly sound one, with the exception of the meadow in question."

How, it may be asked, are we to account for such facts as these? The defenders of the theory of innutritious diet, exposure to wet, or allied causes, being the source of rot, surely will not be bold enough to assert that the feeding on watery food, for a few hours, would be so far *permanently* prejudicial to the functions of animal life as to produce a fatal disease of this kind, notwithstanding that the sheep are removed from such food to that which is in every way unobjectionable. We see no satisfactory solution of the problem, except that which is obtained by a knowledge of the natural history of the liver-fluke. This unravels the mystery, and leaves the mind free from doubt as to the cause of these occurrences. Nothing is easier to understand than that the partaking of grasses growing on low-lying and damp places, even for an hour or two, where the penultimate forms of the fluke abound, would convey a sufficient quantity of these organisms into the digestive system of the sheep—their now proper habitat for further development—to perfect flukes enough to lay the foundation for the disease.

The Period of Greatest Danger.

It is considered by many and probably by the larger proportion of sheep-owners, that the months of September and October are by far the most fruitful in causing the rot. Especially does this opinion prevail among those who see in a luxuriant growth of *after-grass* the chief cause of the affection. Thus the "Lammermuir Farmer" states that in *October* of 1810, he "bought a lot of wethers in fine condition from land of a good sound bottom, where the rot was altogether a stranger. They came on the farm about the *middle of the month*, and in a short time were observed to be diseased. The stock on the farm whence they

were taken continued sound, so that the complaint," he says, "must have originated with myself."

The same author also, when describing the disease as it existed in 1817 in his own flock, observes that all the animals which were sold by him up to *August* of that year proved to be sound. To substantiate which he remarks, that in June he sold "a lot of about 1000 hogs and dinmonts to a gentleman in Roxburgh, all of which gave the greatest satisfaction. They were kept by this gentleman for two years, and afterwards sold in fine condition to the butcher. This was well," he adds, "for both parties, for the sales which I made in *October* were all tainted, and from that time the animals consisted more of skins than carcasses. Here, then," he argues, "the facts bear me out in saying that in 1817 no rot had taken place among my stock in the month of *August*, and the whole calamity that followed must have taken place subsequent to that period. Had any latent seeds of the disease been among them, the sales that I made in August must have turned out as bad to the purchaser as the animals that were retained did to myself, which was not the case, and which clearly demonstrates that the cause had been on my own farm. Of this I entertain not the smallest doubt; and, after the most minute investigation, I can attribute it to nothing but an unusual luxuriant growth of grass, occasioned by the mild, soft weather during the months of *September* and *October*, more especially during the first."

Many, if not the majority of practical farmers, concur in these views, but we think without sufficient reason. A wet autumn will unquestionably produce rot, but a wet summer is far more likely to do so. The experience of water-meadow farmers would even lead to the placing the origin of the disease as early in the year as the end of May or beginning of June. "The late Mr. Bakewell was of opinion that after May-day he could communicate the rot at pleasure, by flooding and afterwards stocking his closes, while they were drenched and saturated with moisture."* Very much, however, depends on the temperature which prevails. Should this be high, and much wet fall at the commencement of the summer, the danger would be proportionably great. Speaking in general terms, however, we have little fear of a wet month of May, or even beginning of June; but as Midsummer approaches, so does the danger increase.

Thousands of sheep took the rot at about this period of 1860, and as many, perhaps, subsequently thereto, and onwards into the autumn. The application as well as the value of preventive

* Harrison on Rot, p. 36.

remedies rests on our being enabled to fix the time of the commencement of the disease. It is the circumstance of sheep falling away in flesh, and exhibiting the general symptoms of rot in *the autumn*, that has too often led to incorrect conclusions as to the time of the origin of the malady. Effects have been mistaken for causes. Men have not generally known that from three to four months are frequently needed for flukes in the liver to produce their debilitating effects on the organism of the sheep. Elsewhere we have explained the reasons why an elevated temperature, combined with excess of rain-fall, is dangerous, and need not repeat the argument. We may, however, add that with the end of October all danger, as a rule, has passed away; the approach of cold weather, and especially the occurrence of frosts, speedily removing the cause of the mischief. The natural history of the liver-fluke also satisfactorily explains this. If it be true that practical men hold that the autumn is the most dangerous period of the year to sheep, it is equally true that they agree that a frost at once puts a stop to the reception of the rot. Fairburn, in combating Hogg's opinion of the cause of the disease, remarks, "I have lost from time to time a great number of hoggs by poverty, and I could certainly trace their death to 'want of meat and shelter;' but there were none of those diagnostic symptoms apparent which indicate the complaint called rot. Cold and frosts are always severe on hunger-stricken hoggs; but *I have uniformly found that frost prevented the rot*, and that if the disease had not been taken previous to the arrival of frost, *it never followed that kind of weather*."

Symptoms of Rot.

As every disease is accompanied with a train of phenomena usually designated symptoms, it becomes necessary that these should be carefully investigated, so that the nature of each separate affection may be fully understood. The importance of this procedure is further shown by the circumstance that many symptoms are common to several diseases; while others, on the contrary, belong only to particular affections, and hence afford the pathologist a ready means of forming a correct diagnosis. *Sthenic* diseases as a rule, and especially those centered in the more important organs of the body, are accompanied with such well-marked peculiarities, that the practitioner rarely fails in recognising either their nature or seat. *Asthenic* maladies, on the contrary, are often attended with such general or ambiguous symptoms, that even the most experienced pathologist may, at the outset, fail to fix their site or determine their true character. Affections, however, of internal organs, which commence with

only a slight impairment of function, due to a hidden or unknown cause of irritation, are of all others the most difficult to diagnose. Among these may be named some of the parasitic maladies, of which rot in sheep may be taken as an example. Even in those instances where no difficulty exists with regard to the time of the application of the cause of rot, we sometimes look in vain, for many weeks, for clear evidence of its existence.

Simon, in his 'Lectures on *General Pathology*,' delivered at St. Thomas's Hospital, in the session of 1850, rightly remarks that "if you examine parasitic diseases from first to last, you will find that they are, perhaps of all known maladies, the most essentially *local*. They may be very extensively diffused—may be in very many spots of the body—and the sum total of many small irritations may be a large general irritation; or if the parasites are large, as well as numerous, they may drain the system of blood, and anæmiate and kill the animal, as we see in the rot of sheep. But all we know of parasitic influence on the health—and I may observe that a good deal is known—all, I say, is referable to these two heads: *local* inconvenience from pressure or from irritation; *general* inconvenience, either febricular, from that local irritation becoming inflammatory, or anæmiative by draining and impoverishment of the blood."

The latent stage of rot—viz. the period which elapses between the entrance of the penultimate forms of the fluke and their change into perfect flukes and attainment of sufficient size to begin to drain the organism—is the one which perhaps interests the pathologist more than any other. He sees in it the gradual development of causes which he would fain interpose to arrest; because, if unchecked, he knows they must ultimately undermine the constitution. But he is without sufficient warrant to take action, in so far as the animal itself is concerned, for he can recognise no symptoms of ill health. In some instances, however, practical knowledge will come to his assistance, and when he finds animals surrounded by circumstances that experience has proved will engender rot, he does not hesitate to put into operation the power of prophylactics.

The latent stage of the disease is also the one of the first importance to the practical agriculturist. During its continuance he may avail himself of many means which will to a great extent secure himself against loss; but he, also, too often fails in the right application of these, because he is not warned by any symptoms to suspect the existence of the malady.

Much has been said about sheep fattening somewhat quicker than is usual in the early stages of rot, and occasionally attention has been drawn to this circumstance as warranting a suspicion of the animal's soundness. Mr. Youatt, when speaking of the

early evidences of the disease, says, "there is no loss of condition, but quite the contrary, for the sheep in the early stage of rot has a great propensity to fatten. Mr. Bakewell," he adds, "was aware of this, for he used to overflow certain of his pastures, and, when the water was run off, turn those sheep upon them which he wanted to prepare for the market. They speedily became rotted, and in the early stage of the rot they accumulated flesh with wonderful rapidity. By this manœuvre he used to gain five or six weeks on his neighbours."

Dr. Harrison has also some remarks to the same purport. "Several graziers and butchers," he says, "with whom I have conversed at different times, having observed that sheep are much disposed to feed during the *first three or four weeks after being tainted*, omit no opportunity of producing the disease to increase their profit."

Ellis likewise, as far back as 1749, drew attention to the same fact, remarking, that "at the beginning of a rot, no sheep feeds nor fats faster than a rotten sheep, notwithstanding the plaise-worms multiply as the rot increases. This makes the common saying true, that no sheep thrives faster than a rotten sheep does for a time, and that no sheep decays sooner after it begins to sink in its flesh."

The tendency to accumulate fat by a diseased animal may seem paradoxical, but the more we know of the nature and cause of rot, and of the physiology of the organ chiefly implicated in the malady, the less contradictory does the fact become. The physiological intricacies of this question, involving as they do a knowledge of the processes of digestion and assimilation of the food, respiration, circulation, and the maintenance of animal heat, forbid, however, in an essay of this kind, our doing more than giving a mere epitome of the subject.

Physiologically considered, the liver is an *assimilatory* and *secretory* organ, as well as an *excretory* one, in all of which offices it plays an important part in the manufacture and purification of the blood. The vessel by which it receives blood for the secretion of bile—the portal vein—takes its origin from the capillaries of the *chylo-poietic* viscera; and the nutritive materials of the food, apart from the chyle, which enter these vessels from the intestinal canal are consequently not conveyed at once into the general circulation, but first subjected to the action of the liver. "The blood in the portal vein differs materially from venous blood in other parts of the body. Among other things it is deficient in fibrine and albumen, but contains more red corpuscles, and about twice as much fatty matter; and in animals fed on farinaceous substances more sugar" (Kirkes). "And as, after having passed through the liver, the

fibrine is increased, and other no less important changes wrought in the blood, there seems no reason to doubt that this fluid has been both *depurated* of materials which would be injurious, and *assimilated* more to the character of ordinary blood. Apart from this, fatty matters especially would appear to be elaborated within the gland, either from saccharine substances or from albuminous compounds; for even when no fat can be detected in the blood of the *vena portæ* that of the hepatic vein contains it in considerable amount" (Carpenter).

In the recent experiments also of Dr. Harley and Professor Sharpey communicated to the Royal Society, it has been shown that even when the portal blood is devoid of sugar, as in a fasting animal or one fed *solely on flesh*, sugar is found in the liver, having been formed therein. We may here observe that, chemically considered, starch, sugar, and fat, are allied substances, being all hydro-carbonates, sugar containing a somewhat greater quantity of carbon than starch, but less than fat.

The bile, as may be easily supposed from the foregoing premises, is a very complex fluid, and has a more important office to perform in the assimilation of food than in the carrying away of materials which impair the purity of the blood. Entering the intestine—*duodenum*—by means of the main biliary duct, it commingles with the chymous mass—the digested food—as this passes from the stomach; and, assisted by the fluid secreted by the pancreas, which is also present in the intestine, effects the chylification of the chyme. The chyle thus formed is absorbed by the lacteals, and carried by them into the general circulation. In the process of chylification a portion of the bile—the colouring matter in particular—as excrementitious material is moved onwards with the unassimilated parts of the chymous mass and ejected as fæculent matter. That portion of the fluid, however, which is employed in effecting chylification, among other things, acts on the amylaceous matter—starch of the food—and converts it into sugar, ready to be taken up by capillary blood-vessels. The presence of bile in the intestine is also said to cause a more free absorption in augmented quantities of the fatty matter of the chyme.

The liver may thus be regarded as the great regulator of the amount of sugar and fatty matter in the blood, any excess of which, not required to support animal heat, accumulates in the various tissues of the body. If this be so, the more active the secretory function of the liver, the greater the amount of sugar and fat which will be absorbed from the food.

Now it is to be remembered that *irritation* simply increases the normal secretion of a gland; but that *inflammation*, on the contrary, alters its character. The entrance of recently developed flukes into the biliary ducts, acts for a time, as has been

previously explained, as a local irritant only, and as such keeps the liver in a state of activity, so that in turn more fat is deposited in the tissues. Thus the placing of sheep upon good grazing, but rot-giving pastures, proves not to be an *immediately* unprofitable proceeding.

The time for the accumulation of fat having passed away, the animal begins to lose condition. The entozoa have now turned the scale. They have laid the foundation for *structural* changes in the liver. The bile also is being gradually changed in quality, and the liver can no longer efficiently maintain its office of a sugar-forming organ, or an elaborator of fibrine. Imperfect chylification is a necessary accompaniment, and the blood soon lacks purity as well as quality. Its quantity likewise suffers, for its development is restricted. The same amount of food which had sufficed to support, or even to give increase of bulk to the body, cannot now minister to the growing wants of the system.

These great changes in the condition of the animal may have insidiously crept on, but they are none the less serious on that account. As time passes, the wasting becomes more and more perceptible. The placing of the hand on the back of the animal will show that the muscles on each side of the vertebræ are so attenuated that the spinous processes of the bones project above them. The animal, in common language, is "razor-backed." The same leanness pervades the entire frame, and everywhere the processes of the bones are more prominent than usual. The general contour of the body is also changed. Often, when the wasting commences, the belly is gaunt, but it soon begins to enlarge and grow pendulous from effusion into the cavity. In the advanced stages of the malady this gives a still further altered outline to the body, for the loins now sink or droop, and the animal becomes "hollow-backed."

The general surface of the skin loses its ruddy hue, and becomes deficient of the unctuous secretion which in health belongs to it. This renders the wool harsh and dry, and leads also to its easy separation from the follicles. A dry scaly state of skin, on the inner parts of the thighs, particularly where it is uncovered with either wool or hair, is likewise early to be recognised.

The animal soon becomes dull and dispirited, and has a peculiar dejected appearance, with an expression of countenance common to many entozoic diseases. "The Ettrick Shepherd" has a quaint tale about this. Once, he says, he was conversing with Mr. Adam Bryden about distinguishing a rotten sheep while at large with the flock, and asked him how this could be done; when "he answered in his usual shrewd and comical style: The late Advocate Mackintosh's method of discerning a good man is the best in the world whereby to distinguish a

sound sheep. His maxim was, 'I never like a man if I don't like his face!' So say I of a sheep."

An examination of the eye will materially assist in determining the question of disease. If the lids are everted and the *membrana nictitans* pressed forward, it will be found that in the *early stages of the malady*, and especially if the animal has been excited by being driven a short distance, *the vessels of the conjunctiva are turgid with pale or yellowish coloured blood, and that the whole part has a peculiar moist or watery appearance.* Later on, the same vessels are blanched, and scarcely to be recognized; excepting perhaps *one or two* which present a similar watery condition, or are turgid with *dark-coloured* blood. The state of the conjunctival membrane is held to be a symptom of importance; and rightly so, because it affords a good means to determine the extent of the changes the blood has undergone. It marks the amount of loss of the red cells of the fluid, and shows also the diminution of the relative quantity of the albumen and saline materials, upon which its specific gravity depends. It is only in blood of proper density that the red cells can be developed. The loss, therefore, of albumen and salts will lead to a relative decrease of the cells, and a corresponding increase of the watery element.

This blanching of the vessels of the eyes has been commented on by some of our earliest writers. Sir Anthony Fitzherbert thus spoke in 1532: "Take both your hands and turn up the lid of his eye, and if it be ruddy and have red strings in the white of the eye, then he is sound; and if the eye be white like tallowe, and the stringes dark-coloured, then he is rotten."

Gervase Markham, in his *Cheape and Good Husbandry*, previously quoted from, has a curious epitome of the symptoms, which we here transcribe: "If a sheepe be sound and perfit, his eye will be bright and cheerefull, the white pure without spot, and the strings red; his gummes also will be red, his teeth white and even, his skinne on his brisket will be red, and so will each side betwixt his body and his shoulder where the wool grows not; his skinne in general will be loose, his wool fast, his breath long, and his feete not hot; but if he be unsound, then these signes will have contrary faces, his eyes will be heavy, pale, and spotted, his breast and gummes white, his teeth yellow and foule, and his wooll when it is pulled will easily part from the body."

In addition to the symptoms we have named it will be found that the animal's appetite becomes fastidious. To-day it feeds pretty well; to-morrow it will scarcely touch food of any description. An increased thirst, however, is now present, and continues till the end. The animal is often going to the brook or pond, or, if prevented from doing this, will omit no opportunity of drinking from the little hollows which may exist on

the surface of the field. This desire for water evidently depends on the continued drain from the blood of this important constituent of its composition. No less than 784 parts out of every thousand of pure blood consist of water. The relative proportions of its constituents may be here given, as it will help to explain many of the phenomena of the disease. They are as follows :—

Water	784·
Red corpuscles	131·
Albumen of serum	70·
Saline matters	6·03
Extractive, fatty, and other matters	6·77
Fibrine	2·2
	1000·

Associated with the increased thirst is an irregular state of the bowels. For a few days together diarrhœa will be present, when it gives way to the ordinary condition of the fæces. A persistence of this variable state of the evacuations, when not traceable to a change of food, or other common causes, is to be regarded as a suspicious circumstance. It is often due to an altered state of the bile, by which the fluid acts as an irritant to the mucous membrane of the intestines : sometimes, however, it would appear to depend on an irregular flow of this fluid from the biliary ducts. The distomata by their movements must occasionally form mechanical impediments to the free passage of the bile, leading firstly to its accumulation, and then its sudden flow onwards, when the obstruction is removed, particularly when they locate themselves within the *ductus communis choledochus.*

As the disease advances to its fatal termination the breathing becomes short and quick, and is occasionally accompanied with a slight and nearly inaudible cough. Œdematous swellings come on in different parts of the body, especially around the throat and beneath the lower jaw. The accumulation of the effused fluid in this situation is to be referred chiefly to the pendant position of the head in feeding. There is no surer proof of approaching death than these œdematous swellings, for they indicate a dropsical condition of the entire system. The prostration of the vital powers day by day increases. The pulse becomes weak, wavering, and indistinct. The animal lies a good deal, refuses all food, is in a state of semi-stupor, and dies from pure exhaustion, as the consequence of general anæmia.

Progress and Duration.

Many causes are in operation to influence the rapidity with which the organism of the sheep yields to the influence of rot.

Some of these belong to the conditional state of the animal itself, and others to the circumstances by which it is surrounded. Apart from such diseases as may co-exist with rot, the chief of the systemic causes are the number of distomata inhabiting the biliary ducts, the natural stamina of the animal, and its condition as to amount of flesh at the time of the declaration of the symptoms. Age also, and the purposes for which the animal is kept, exercise an important influence upon the progress of the affection. Thus breeding or nursing ewes, from the demand made on their systems for the development or support of their young, will generally succumb more readily than store sheep, and most assuredly much sooner, all other things being equal, than those which are being fattened for the market. Lambs also, when affected in the first few months of their age, for want of sufficiently matured strength of constitution, will soon sink under the malady.

Among the external or surrounding circumstances few are so potent for good as a continuous supply of food rich in the elements of blood, and containing comparatively a small proportion of water. Sheep thus fed will long resist the progress of the malady. A notable instance of this is furnished by the following fact:—A gentleman residing in Norfolk, the occupier of a large tract of heath-land, purchased, a few years since, a number of sheep in the latter part of August. In the month of February of the following year he became aware for the *first* time that the animals were affected with rot. Subsequently to this they began to die, and a great number were soon lost. Being fully satisfied that the sheep had not contracted the disease while they had been in his possession, he sought out the dealer from whom they had been bought; and on inquiry it was found that other sheep from which these had been selected were also the subjects of the malady. So satisfied was the dealer that the whole were diseased when sold by him in August, that he at once agreed to take them back and refund the money.

The remarkably slow progress of the malady in this case was due to the circumstance that the sheep, after coming into possession of their new owner were placed upon a dry sandy soil, and were well supplied with food rich in nitrogenous materials, besides being protected in a great measure by folding from inclement weather. Had causes the opposite of these been in operation, the disease, without doubt, would have declared itself at a much earlier date, and have run its course far more rapidly.

For similar reasons many sheep which contracted the rot *late* in 1860 lived on through the winter, and, not only so, but far into the following year. The weather of 1861 proved the very opposite of that of 1860, and we are acquainted with numerous

instances, even on the cold-clay, grass-land farms of Middlesex, where diseased animals were kept throughout the entire *summer* without any material loss to their owners. Some few persons even ventured to select their ewes for breeding from among them, believing that, as the sheep had done so well hitherto, they would still answer for this purpose. They had, however, to repent their temerity, for no sooner did the grasses begin to lose their goodness, and autumnal weather to set in, than the animals rapidly declined, despite all the care which could be bestowed upon them.

Fairbairn, so often quoted by us, narrates an instance of the inutility of good food and shelter to diseased sheep *at the end of the year.* He says, "In 1810 I put a fine lot of dinmonts upon turnips before Martinmas," — November 11th — "and although in very favourable condition, as I was beginning to suspect they were affected, and under the idea that meat and shelter would provide against every exigency, I sent them from my own farm to a fine, dry, well-sheltered situation in the middle part of Berwickshire, where I expended no less than 100*l.* upon turnips, but before the month of March there were few of them remaining, and I did not realise as much as defrayed the expenses laid out upon the turnips." A result of this kind was to be expected, and forcibly shows the folly of expending money upon rotten sheep in the *winter months.*

It is easy to understand that the existence of flukes in the liver being associated with an almost continuous supply of watery or innutritious food, and exposure of the animal to a low temperature and variable weather, will the sooner produce an anæmiated state of system than when the opposite state of things obtains. The entozoa will of necessity now drain the blood of its albuminous constituents faster than these are furnished. Besides, their presence within the biliary ducts under such unfavourable circumstances will earlier lay the foundation for those structural changes in the liver itself which unfit it for the secretion of sufficiently pure bile to contribute to the making of healthy blood. Hence an additional cause of the quick progress of rot in the autumn and winter, more especially if wet weather should long prevail.

In innumerable instances, however, and at other periods of the year, the two chief causes of mischief—innutritious diet and existence of flukes—are not combined sufficiently long for the former to play so important a part as to produce *persistent* deleterious effects. We have a good proof of this in those cases of the engendering of rot by the pasturing of the sheep on wet meadows for a limited space of time, and hence we must look

to the presence of the flukes themselves, and also to their number, for an explanation of the fact.

The ill effects attending entozoa of every description are mostly dependent on the largeness of their number, but not unfrequently also on the importance of the organ in which they are located. A few flukes, by the simple irritation they produce, are frequently non-productive of mischief, at least to any practical extent, in deranging the functions of the liver. Hence the daily occurrence of sheep, which had been fed for the market, and which had gone on to the perfect satisfaction of their owner, being found to have a limited number of these entozoa in their biliary ducts, the existence of which was not only unsuspected, but would perhaps not have been believed in, but for the circumstance that they were brought to light by the slaughtering of the animal.

This fact is mainly due to the circumstance that the fluke, as has been explained, does not multiply its species within the biliary ducts; for if the contrary were the case—*namely*, that young flukes were produced therein, and that these in due time became the parents of others—what, it may be asked, would then have been the result? Why, that these infected sheep, instead of being made fat enough for slaughtering, would gradually have lost flesh, and ultimately have died anæmiated, even if not more than a dozen of the entozoa had originally occupied their biliary ducts.

Thus we see the necessity of becoming conversant with the method of propagation of each entozoon, to be enabled to speak with any certainty of the ill effects attending its presence. The trite remark, "Oh, a few worms do no harm," may prove true, provided the parasites are inhabiting a part of the organism which is comparatively of little importance to the direct maintenance of vitality, and that they do not multiply their species therein so as greatly to increase in number and speedily lay the foundation for structural disease.

Much also of the ultimate mischief resulting from entozoa will depend, as has been stated, on the importance of the organ in which they may be situated. Thus a *single hydatid* in the brain will by its pressure produce serious disease, and ultimate death of the affected animal; while a dozen or more hydatids located within the lungs, liver, or other organs, will be unrecognised during life from any pressure or irritation they may produce. Facts of this description are frequently too little regarded in estimating the influence of parasites on the health of animals. They have, however, an important practical bearing on the disease in question, as has been already explained.

Thus we see that the rate of the progress, as well as the duration of rot, are governed by a variety of circumstances, and that many of these are so occult and changeable as to forbid our predicting with any degree of certainty how long affected sheep may bear up against the disease.

With regard to the time of the manifestation of the symptoms after flukes have entered the biliary ducts, it is also impossible to speak with any degree of certainty. A combination of unfavourable circumstances may give rise to the symptoms in five or six weeks; while, on the contrary, the majority of things being favourable, even months may pass before rot is suspected to exist. No hasty generalizations should ever be come to on such a point as this, and more especially when an action at law may hinge on the opinion which is given. A patient inquiry into the history of each individual instance can alone furnish correct data to act upon.

Post-mortem Appearances.

The lesions to be observed on inspecting the body of a sheep affected with rot will vary according to the progress of the malady, be it quick or slow. They will also be modified by the circumstance of the animal having either sunk from the disease, or been slaughtered in its early or late stages. The emaciated state of the frame often strikes us with surprise, the dead animal appearing to be little more than "skin and bone." The wool is found to be harsh and dry, and to pull easily from its follicles. The colour of the skin is pale, excepting perhaps in places where it assumes a purplish hue from approaching decomposition. It likewise tears readily on the application of moderate force, from having lost much of its natural firmness. The visible mucous membranes are colourless, or have a slight yellow tinge. The belly is often large, and gives evidence of containing a quantity of fluid.

On removing the skin, the fascia covering the muscles is frequently found to have a yellowish hue, while the muscles themselves are shrunken in size, soft, and flabby. They have also lost very much of their normal colour, and do not stiffen as is usual. Little or no fat is met with; but, on the contrary, the areolar tissue is infiltrated to a greater or less degree with serous fluid, remarkable for its watery character. This dropsical effusion is observed to have accumulated here and there, and particularly about the front and lower parts of the neck, and around the lower jaw.

On laying open the abdominal cavity exit is given to a quantity of serous fluid, the physical properties of which vary considerably in different cases. In sheep *killed* for an investigation

of the disease, even in the advanced stages, the fluid will mostly be found limpid and transparent, differing but little in appearance from ordinary serum; while, on the contrary, in those that have succumbed to the affection it is often turbid and of a dirty yellow or yellowish-red colour. Much of this variation in colour is due to transudation from the vessels after death; and the hue will consequently be modified according to the time which has elapsed between the death of the animal and the making of the autopsy.

The blood-vessels of the mesentery are indistinct, and effusion exists between its serous layers. The omentum is almost devoid of fat, and, like the other structures, has a yellow tinge. The coats of the stomachs and intestines are pale; and the fæculent matter contained in the latter is usually soft and pulpy.

Effusions of serum, wholly or in part, supplant the fat which ordinarily covers the kidneys; and when the two co-exist a peculiar speckled appearance is produced beneath the serous membrane by the commingling of the fat with the fluid. The kidneys are both paler and softer than natural; but their structure is otherwise unaffected. The rest of the urinary organs, and also those of the generative system, are healthy, but partake of the general pallor which pervades the frame.

The liver is the organ chiefly affected, nevertheless it presents characters in some instances the very opposite of those which are met with in others. It is mostly altered in shape, size, and colour. Its outline is irregular, and its surfaces, especially the abdominal one, often nodulated by a condensation or shrinking of the substance of the gland in some parts, beyond that of others. As a rule, it is diminished altogether in size, and changed from its reddish-brown or chocolate hue to a pale or dirty-coloured yellow. Occasionally its surface is studded over with red spots, which contrast greatly with the yellow clay-like colour on which they rest. Sometimes these specks are mingled with others of various hues, imparting to the organ a peculiar mottled condition, which led Harrison to remark, in 1804, and Youatt to repeat many years afterwards, that the liver "in some cases is speckled like the back of a toad."

Its general structure is condensed, imparting a hard and sometimes gritty feel to the finger, more particularly in long-standing cases of the disease. In other instances the normal colour is less altered, and there are greater evidences of simple venous congestion. This is denoted chiefly on the abdominal surface, which is both striated and spotted by the enlarged and congested blood-vessels which lie in the course of the main biliary ducts. These ducts are diseased more or less in all cases of long standing. Their coats are thickened and hardened, and their calibre dilated, often to an extent sufficient to admit the end of the finger. They appear

as bluish-white lines, more or less continuous, running by the side of the congested blood-vessels, from the central part of the gland towards its lower edge. In some places they are rendered very distinct by projecting above the surface, being here dilated into pouch-like cavities. The coats of the *ductus hepaticus*, as also of the *ductus communis choledochus*, are not unfrequently so thick as to be upwards of ten times their normal substance, and likewise so hard as to approach the nature of cartilage.

On slitting up the ordinary biliary ducts, as we approach the smaller branches, this hardness increases, and the coats are found to be rough and uneven, arising from calcareous deposits —phosphate of lime and magnesia—within their tissue. It is this which gives the gritty feel to the surface of the liver, and imparts a crackling sound on cutting through its substance.

Within the ducts we encounter numerous *distomata*, which are often here and there, and especially in the pouches, so closely packed as to block up the passage. Their number, however, is liable to great variation, and, it has been rightly asserted, is not always in proportion to the extent of the structural changes in the liver. No doubt secondary causes play a not unimportant part in these changes, and so also does time; but nevertheless the lesions of the liver are upon the whole so peculiar that, were no entozoa present, a pathologist would ascribe them to such a cause, and none other. Distomata will often quit the liver by passing into the intestinal canal through the *ductus communis choledochus*, especially when the *entire* structure of the organ has become impaired. Their food is the bile, and the more this is changed in quality, which is always in proportion to the extent of the structural disease of the liver, the less suitable it will be for their support. Besides this, these entozoa, in common with all other creatures, have their ordinary limit of life, and, be this what it may, it is not unreasonable to suppose that their approaching dissolution may at times possibly be an additional reason for their quitting the biliary ducts.

We have frequently met with dead flukes in the intestines and sometimes in the liver, and occasionally have found them forming the nuclei of biliary concretions. One remarkable instance of this was a short time since brought to our notice, where the concretion was as large as an ordinary hen's egg, and when broken up was found to contain about a dozen dead flukes. It was lying in a pouch-like cavity of one of the biliary ducts.

Another reason must be named as explanatory, perhaps, of the cause of but few flukes being met with in the biliary ducts, when the extent of the lesions of the liver does not bear a comparison

with their number, *viz.*, that on the death of the animal, whose body they inhabited, taking place, they leave their original location, as if making an effort to escape from their own consequent death. Many of the intestinal worms, the *ascares lumbricoides*, the *tæniæ*, *trichocephali*, &c., comport themselves in this manner; and in so doing they often form large masses or knots in a part of the intestinal canal foreign to their ordinary dwelling. The lumbricoid worms have been known, under such circumstances, to enter the stomach, and even to pass up the œsophagus into the mouth to effect their escape. We have occasionally found them crowded into the duodenum so as to literally block it up throughout the greater portion of its length, being arrested in their effort to enter the stomach; two remarkable specimens of which are preserved in the Museum of the Royal Veterinary College, one from the horse and the other from the pig.

Should the same thing take place with regard to flukes, a search for them in the intestinal canal will prove successful. That their number, however, is often very large within the biliary ducts, we have daily proof; and it is said that Leeuwenhoeck took no less than "870 out of one liver, exclusive of those that were cut to pieces or destroyed in opening the various ducts."*

Tracing the smaller ducts onwards, exit is given to a dark-brown and thickish fluid, among which are masses varying in size from the head of a pin to a pea, or occasionally larger—collections of the ova of the distomata held together by the mucus of the ducts and inspissated bile. A drop of the fluid, or a minute portion of one of these masses, placed under the microscope, reveals the fact that in the small ducts, especially, the ova are to be met with in countless myriads. We obtain evidence also of another very instructive circumstance, to which attention has been previously directed, by simply putting a little of the matter upon the edge of a plate or slip of glass and lightly pressing it with the point of a scalpel — namely, that the ova have remarkably hardened shells or cases, which doubtless enables them, when out of the body of the sheep, to long retain their vitality by resisting all ordinary causes of decomposition. We feel them as so much gritty matter, and we hear them cracking under the pressure of the knife.

The gall-bladder itself is not much altered in structure, nor does it in general contain many distomata; but the bile within it is mixed with a considerable quantity of mucus, and its colour is altered from that of the greenish-yellow which normally belongs to it. Ova are also met with here, but in scanty quantities compared to the biliary ducts.

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* Youatt on Sheep, p. 449.

The morbid states of the liver which we have attempted to describe are, without doubt, chiefly due to the presence of the entozoa within the biliary ducts. Küchenmeister has correctly observed, that "the *first* consequences of the flukes in the liver are dilatation and catarrh of the gall-ducts, and destruction, by pressure, of large portions of the parenchyma of the liver in the vicinity of the enlarged ducts." No kind of food or location, however prejudicial, could possibly *per se* produce such structural changes in the liver as belong to rot; but it can be easily understood that an organ like this, whose office at one and the same time is to depurate the blood by its *excretory* function, and to assist in the assimilation of the food by its *secretory* function, being so extensively diseased, must ultimately cause emaciation and death of the animal, without regarding the distomata as an additional cause in producing a continued drain on the system of the sheep.

To return to our description of the autopsy. The viscera of the chest, in common with every other organ of the body, give evidence of anæmia. Some serous effusion exists in the cavity, which, however, is mostly devoid of colour, limpid, and transparent. In quantity it is considerably less than that met with in the abdomen. Little or no fat is present about the heart; and that which does exist is of a slightly yellow colour. The walls of the heart are flabby and pale. The blood contained in its cavities, as well as that in the large venous trunks, is watery and imperfectly clotted. The lungs, apart from other diseases of these organs which may co-exist with rot, do not present any special lesions. Like other parts of the organism, however, they give evidence of general anæmia. In our section on the pathology of rot, we have fully discussed the opinion of Mr. Blacklock, as to the malady being a tuberculous one of the lungs, and therefore need not repeat our arguments against the correctness of this statement.

The condition of the brain and its meninges agrees with that of the body generally. A larger amount of fluid than ordinary is present in the ventricles of the brain, and the vessels of the meninges are indistinctly seen in consequence of the watery character of the blood within them. Such, then, are the general *post-mortem* appearances of rotten sheep.

We have, however, many proofs that affected sheep often die long before this general break-up of the organism is accomplished. This is particularly the case at the commencement of winter, and on the occurrence of white or hoar frosts. Such animals sink from *passive congestion* of the lungs, the tendency to which is given by the altered condition of the blood from a change in the

relative proportion of its several constituents. Dr. Carpenter and other physiologists rightly remark that a diminution of the specific gravity of the blood, from a loss of its saline and albuminous materials, predisposes to hæmorrhage, congestion, &c.; and such we know to be the condition of this fluid comparatively early in this disease. The lungs, in such cases as these, are red throughout, being charged with blood. They are also heavy to the feel, and portions of them will be found to sink in water. The vessels of the pleura and pericardium are likewise overloaded with blood. The flesh of such animals is of fair colour and tolerably firm. Some fat also, not much changed in consistence, exists around the kidneys, and in other places of ordinary deposit. The yellow hue of the tissues, so generally present, is considerably less in amount, and is sometimes scarcely to be noticed. The liver, however, is mostly of a clay colour, and its ducts are crowded with distomata.

In concluding this section of our essay, we add a few words with reference to the effluvium which arises from the carcasses of rotten sheep. This is often extremely nauseating, even when the animal is opened directly after death. We have on more than one occasion known persons to be taken seriously ill when engaged in opening many rotten sheep at a time. A remarkable instance, not only of sickness, but of death, was brought to our notice in *August* of 1854. A person of intemperate habits, following the occupation of a country butcher, was employed in skinning and dressing a number of rotten sheep on the premises of a farmer in the county of Norfolk. The sheep were necessarily opened when *warm;* and, while he was so engaged, he complained greatly of the sickening smell. The same evening he was attacked with choleraic disease, and two days afterwards was a corpse.

That the bodies of rotten sheep quickly undergo putrefaction is well known, and elsewhere this is assigned as a reason for the name given to the malady; but that injury may arise from the effluvium accompanying the vapour given off from their still warm bodies after death is not so generally understood.

Treatment of Affected Sheep.

The successful treatment of a disease is necessarily based on a knowledge of its pathology, without which the application of all remedial means becomes mere empiricism. It were well for the ends of science if information of this kind invariably tended to the discovery of a cure for each separate affection, but unfortunately it too frequently leads to the very opposite result. The

more we understand of the nature of some diseases, the more we despair of being able to eradicate them, or even to mitigate their effects. It is the possession, however, of this knowledge which marks the difference between the man of science and the mere empiric. The latter rushes in, and boldly declares his ability to cure that which is incurable; while the former honestly declares his inability to do anything for good. Correct pathological knowledge will doubtless prove that the *cure* of rot can scarcely be hoped for, although much may, nevertheless, be done to arrest its progress.

Many remedies of empiric origin have been forced on the notice of agriculturists from time to time, both in this country and also on the Continent, for the cure of rotten sheep—all of which have, however, signally failed in verifying the statements of their originators. At the commencement of the present century a remedy emanating from a Dutch source was loudly extolled, and even largely used in this country as well as in Holland, but it soon fell into disrepute—following in this respect those which had gone before or have since succeeded it.

Mills, in his work on cattle, after speaking of the employment of certain medicinal agents which are too commonplace and valueless to be here quoted, says that a Mr. Baldwin, of Clapham, Surrey, found *burnet* to be a remarkably efficacious cure for rot, "as appears from a letter of his published in 'The Repository for Select Papers on Agriculture, Arts, and Manufactures,' 1768." Mills adds to this statement the following: "A farmer in the north, in the autumn of the year 1766, when all his sheep were so far gone in the rot that he did not expect one of them to live the winter over, sent them into a field of burnet, which in a month's time restored them to perfect health."

After diligent search we have been unable to find any other authority on the *curative* properties of burnet, nor do we believe in this power of the plant. All that could be hoped for would be that sheep feeding upon it, especially when mixed with good grasses, might be enabled to resist for a somewhat longer time the inroads of the disease.

Martyn, a late Professor of Botany in the University of Cambridge, in his '*Flora Rustica*,' 1792, says: "Burnet is common in high pastures on a calcareous soil. It flowers in the beginning of May, and sometimes in April. The leaves, when bruised, smell like cucumber, and taste something like the paring of that fruit; they are sometimes put into salads and cool tankards." He adds that "Some years since Mr. Rocque attempted to introduce it as food for cattle. It has one good quality, which is, that it continues green all winter, and affords some food early in

spring, when it is commonly wanted. But cattle are not very fond of it, nor does it yield a sufficient burden to pay the farmer for the expense of cultivating it."

Several writers on agriculture remark that when burnet constitutes a moderate proportion of meadow-hay it imparts a stimulating property to the fodder, thereby rendering it more suited for feeding with turnips; but if burnet be cultivated by itself and made into hay, the provender is coarse and unpalatable, and rejected as a rule by most animals.

Most authors, however, on the diseases of the sheep, place their chief reliance on medicinal agents for the cure of rot; the particular remedies they advocate depending rather on their own preconceived notions of the disease than on any precise information of its nature. We give a few extracts:—

Sir G. S. Mackenzie directs attention to the beneficial use of mercury, but says that "it would, perhaps, be improper to administer this agent internally. The safest and most effectual method of applying it is in the form of the common blue ointment, and a trial of this is strongly recommended to those whose flocks are liable to rot. It should be applied to the bare skin in the region of the liver; and the size of a nut rubbed in till it is all dried up twice a day for a week or ten days. This, in conjunction with wholesome food, will in all probability prove to be the most effectual treatment. Mercury is well known to be a specific for diseased liver of the human body, and on that account we may presume that it will be efficacious in the cure of the same organ in sheep, and it is also recommended as the most effectual means of destroying the fluke-worm."

Mr. Youatt, adopting the views of those who regard the affection as an inflammatory one of the liver, advises at its commencement that the animal be bled to the extent of "8, 10, or 12 ozs.," and that this be followed up by an aperient, consisting of 2 or 3 ozs. of Epsom salts; and he adds, "the physic having operated, or an additional dose, perchance, having been administered in order to quicken the action of the first, the farmer will look for further means and appliances. Friction with mercurial ointment on the region of the liver has been recommended, but not by those who have had opportunity to observe its secondary effects on the ruminant. Still the disease under consideration, with evident determination to the liver, requires the agency of this powerful but dangerous medicine. Two or three grains of calomel may be given daily, but mixed with half the quantity of opium, in order to secure its beneficial, and to ward off its injurious, effects on the ruminant. To this should be added—a simple and cheap medicine, but that which is the sheet anchor of the practitioner here—common salt."

Clater, who boasts of curing "9 *sheep out of* 10 *even in the last stage*" of the malady, recommends the following medicament:—

"Nitre in powder, 6 ozs.
Ginger, fresh powdered, 4 ozs.
Colcothar of vitriol (red oxide of iron) in fine powder, 2 ozs.
Common salt, 3½ lbs.
Boiling water, 3 gallons.

"Pour the water hot upon the ingredients; stir them, and when new milk warm, add to every quart of the mixture 3 ozs. of spirit of turpentine, and bottle it for use."

When using the medicine, we are instructed that "the following directions must be strictly regarded:—Keep the infected sheep from food all night; on the following morning give to each 2 ozs., or 4 table-spoonfuls of the above mixture (remember to shake the bottle well at the moment of pouring it out). To those which are weak and much reduced by the disease, one-half, or three parts out of four, may be sufficient for a dose. Keep them from food three hours after giving the medicine, and then turn them into a dry pasture. It will be necessary to repeat the medicine every fourth day for three times, observing the above rules; but where only half the quantity has been administered, it will be proper to repeat it every second or third day for six times."

This recommendation of Clater may be taken as a fair specimen of the treatment generally advised by the empiric writers of his day. It is, however, unnecessary to quote from their works, as nothing of value can be obtained therefrom. No instances of cure are given, nor is any light thrown on the nature of the disease.

We find, however, a circumstance narrated by Fairbairn, which we transcribe, in further proof of the value of salt:

"In the year 1817," he says, "an active shepherd in my neighbourhood, who had the charge of 200 ewes, observing some of them tainted with rot, bethought himself of trying the experiment of curing them, and conducted it in the following way:—Whenever he saw any one or more of them showing unequivocal symptoms of rot, he brought them into a dry court-yard or empty house, and fed them with hay, turnips, or a few oats. To every one of them he gave *twice* a day a handful of salt, which he dissolved in water, and putting the solution into a teapot, poured it down their throats.* This was repeated for several successive days, and continued till some improvement in the condition of the sheep was discernible, after which they were turned into the field. If the reappearance of the symptoms did not justify their continuance with the flock, they were again conducted home, and the salt, as before, administered. Few of them required more than two such courses, but a great proportion of the flock was treated in this manner, and the shepherd delivered the whole of them alive at Whitsunday, except one ewe which had died in lambing."

* The quantity of salt here recommended would weigh nearly three ounces, an amount which could not be daily used with safety.—AUTHOR.

Before commenting on any of the foregoing methods of treating rot, we purpose to give the one which is adopted by the Bedouin Arabs. We learn from the writings of MM. Hamont and Fischer, previously quoted, that when the Nile returns to its bed, the sheep of the Arabs go to feed on the *dysse* which springs up on the partially-recovered land (*see p.* 77), and as soon as "the first symptoms of the affection appear, the vigilant Bedouins lose not a moment; they reassemble their flocks, and drive them back to the desert. In the midst of the sands their principal food is the *salt-wort*"—*Salsola Kali*. After some days the symptoms of the rot gradually disappear, and the sheep regain their former health." It further appears that the Bedouins know of no other remedy, and should this not prove beneficial, they proceed to slaughter the affected animals.

To return to some of the opinions we have quoted; and first, a word with regard to Sir G. S. Mackenzie's mercurial inunction. Apart from the arguments advanced against it by Mr. Youatt, in the extract we have given, we object to this method of employing mercury, as being perfectly useless. No amount of absorption of the agent from the skin could possibly affect the vitality of the flukes; and as the cause of the malady would remain unchecked, so must its effects necessarily continue. But even a greater objection could be raised against it than this. Mercury is well known to produce a particular effect on the blood, lessening the amount of its fibrine, and rendering the fluid aplastic, and therefore doing the very thing we desire to avoid in this disease. It is only by our keeping the blood rich in its proximate principles, as has been elsewhere pointed out, that the system is enabled the longer to resist the progress of the malady. For similar reasons we dissent entirely from Mr. Youatt's advice to use mercury in conjunction with opium. This compound would be of great value succeeding upon the withdrawal of blood and the exhibition of aperient medicine in *active inflammation* of the liver, as also in a similar condition of other organs, but it is positively injurious in rot. We are unable to reconcile Mr. Youatt's treatment with anything belonging to the pathology of this disease. It can only be accounted for by his having erred in considering the affection originally as one of inflammation.

With reference to Clater's prescription, which, as has been explained, is but a type of many others of similar origin, we have a good proof of the want of scientific knowledge which generally prevailed among those who wrote of the diseases of animals at the beginning of the present century. Whatever value it may possess lies in the amount of salt it contains; otherwise it is but little calculated to do any good.

No treatment of rot can be considered as being more than

palliative; still in carrying this principle into practice great benefit often arises, as the owners of infected animals are secured against losses which otherwise would be very heavy. The earlier the disease is detected the better, but unfortunately its discovery is too frequently not made until the autumnal period of the year, when external circumstances are much against the success of any system of treatment or management, and when also structural changes have begun in the liver. Should the disease not be detected until this period, no effort must be spared to quickly check its progress; otherwise the fatality will be very great.

The animals must be carefully guarded against all vicissitudes of weather by being folded in the best sheltered situations, more especially at night. Their food should consist of the most nutritious materials. Indeed, waste of the tissues, particularly when due to simple anæmia rather than organic lesions, will demand not only a liberal supply of food rich in flesh-forming—nitrogenous—principles, but also such as contains a large proportion of sugar, starch, or other carbonaceous matters, that the heat of the body may be kept up equally with nutrition. If placed on meadows or artificial grasses, the sheep should be often changed from pasture to pasture, care being taken to avoid those which are wet and cold, or which contain inferior herbage. Manger-food must be supplied, and this should consist, in part at least, of *crushed* corn, of which the leguminous plants, beans, peas, lentils, &c., are to be preferred. Oats and maize are also good, and to these a moderate allowance of oilcake may be added. Frequent changing of the food will induce the animals to eat more, for which reason, when they are on the pastures, we take no objection to an occasional supply of turnips or other roots; but, unless compelled by the character of the farm and the system of cultivation, we would avoid continuous folding on turnips. Where this has to be done great care will have to be exercised in regulating the quantity of turnips according to the condition of the crop, the state of the weather, &c. Under such circumstances an allowance of good hay, in addition to the other food, will be imperatively required.

By these means rigorously carried out, provision will be made for the due supply of albuminous and heat-giving materials to the blood, and the consequent nutrition and health of every part of the organism. Dependence, however, must not be exclusively placed on diet. Medicinal agents will have to be had recourse to, preference being given to those which impart tone and vigour to the system. Conjoined with these should be such as experience has shown to possess anthelmintic properties.

Salt cannot be dispensed with. It does good in several ways. It is an agent which acts as a stimulant to the process of digestion,

and, by its ready solution and free entrance into the blood, it will supply also any amount of soda which may be required in the secretion of bile, the saline constituents of which include the chloride of sodium—common salt—with that of potassium, and the phosphates and sulphates of soda, potash, lime, and magnesia. Another advantage is connected with the exhibition of salt and its entrance into the blood, namely, that it contributes with other saline and albuminous matters to preserve that proper specific gravity of the fluid which ought to be "equivalent to that of the contents of the red corpuscles, as it is only in this condition that the formation of the latter can duly take place."—(*Carpenter.*)

The other medicinal agent to which we refer as indispensable is the sulphate of iron. As a tonic it is excelled by few, if by any, therapeutic agents; while the readiness by which it can be obtained, and the lowness of its price, give it an advantage over many others. Sheep also do not object to take it with their food when mixed in proper proportions; nor is it a matter of much moment if one animal should get rather more than his fellow, by more rapid or longer feeding at the trough. Sulphate of iron is likewise an excellent anthelmintic, quickly leading to the expulsion of several of the varieties of *intestinal* worms. Its chief use, however, in rot is that it is a powerful agent in the reproduction of the red cells of the blood—iron entering largely into the contents of these cells—the *hæmato-globuline.* In all diseases therefore in which there is a diminished power of producing red cells, the sulphate of iron is a valuable remedy.

Stomachics or carminatives are likewise required; of which medicaments we give a preference to aniseed in this affection.

A good compound of these medicinal agents with some highly nitrogenized alimentary matters we have in the following formula. Take of

Finely-ground oil-cake (linseed) .. ,, pea-meal	each 1 bushel.
,, salt .. .. ,, aniseed	each 4 lbs.
,, sulphate of iron	1 lb.

Let the salt, aniseed, and sulphate of iron be mixed together first, and afterwards well incorporated with the cake and pea-meal.

We have the authority of eminent chemists for saying that *even when solutions of salt and sulphate of iron* are mixed together in the proportions here recommended they undergo but little change. The products of the change are sulphate of soda and protochloride of iron, the therapeutic action of which, especially in the quantities in which they are formed, will not materially interfere with the undecomposed common salt and sulphate

of iron. Apart, however, from the question of a partial change in the agents, we can speak confidently of the practical utility of the compound in the treatment of rot. The quantity of it to be given to each sheep daily should be half a pint, in addition to an ordinary allowance of corn or cake and hay-chaff. It may be used with advantage for three or four weeks in succession, but should be discontinued occasionally for a day or two, especially if the animals become affected with diarrhœa.

In the further treatment of rot, attention should be given to the expulsion if possible of the flukes from the biliary ducts—not that we think any medicinal agents can be depended on for this purpose. Nevertheless, trial may be made of the oil of turpentine, combined with linseed oil and nitric æther, in the following proportions:—

Oil of turpentine	of each 2 drachms.
Nitric æther	
Linseed oil	2 ozs.

This may be administered once a day for three or four succeeding days, at intervals of about a fortnight; and, although not positively required, it may be as well if the medicated food compound be suspended at these times. Beyond the adoption of these measures we can see no advantage in the medical treatment of this disease.

Under the head of treatment, however, we must not omit to mention that trial has recently been given to a French remedy for rot. The full particulars of this are set forth in the subjoined report to the Royal Agricultural Society by the author of the present thesis. We deem it right that this should be transferred to these pages for the sake of completeness, and also to record our meed of praise to the gentleman who introduced the remedy to the notice of the English public:—

"*Report on the Employment of a French Remedy for the Cure of Rot in Sheep.*

"It will be remembered that in the early part of the year M. Trehonnais called the attention of the agricultural community to a remedy, much extolled for its curative properties, which had been employed in some parts of France for the rot in sheep, and that M. Trehonnais also very liberally engaged to obtain a sufficient quantity of the agent for trial in this country. The Council resolved, in consequence of this favourable report, on the recommendation of the Veterinary Committee, to purchase some sheep for the experiment, and voted a sum of 12*l.* for the purpose.

"In accordance with this resolution, instructions were given me to procure such animals as I deemed fitting for the purpose, and to commence the experiment as early as circumstances would permit. In selecting the sheep, which were of the improved Dorset breed, I took care that they should be of the same age as near as possible, be also in a condition warranting the belief that they would survive long enough to give a fair trial to the medicine, but

be in different stages of the malady. I preferred one-year-old sheep as offering most of these advantages, and for the further reason that an approximation could be made as to the time they had been the subjects of the malady. Everything being arranged, the experiment was commenced on April 22, 1861, the first thing done being to divide the sheep into two parts, leaving one moiety at the Royal Veterinary College and sending the other to my farm, Oakington, in the parish of Harrow. This was deemed important, as each division would be placed under totally different circumstances, especially as to the kind of food which would be supplied to the animals, and the protection which would be afforded them from ordinary atmospherical changes.

"The sheep left at the College were kept entirely on hay and oats, housed every night in a shed, but allowed the use of a small enclosure during the day. Those sent to Oakington were, on the contrary, placed in a meadow, and had an abundant supply of grass, but no corn; nor were they protected of a night, save when the weather was wet.

"I further determined to give the medicine to *three sheep only* of each lot, leaving the others entirely to their chance. In doing this I selected the apparently strongest sheep for taking the medicine.

"The directions received from France for the use of the agent were that a tablespoonful should be given to each sheep every morning, half an hour before feeding-time, and be continued from fifteen to twenty days to animals in the early stages of the disease, and from thirty to forty days to those in the advanced or latter stages; or even for a longer time in very severe cases. It was further ordered that, as soon as the animals had gained their appetite and strength, whatever other indications of the disease might still exist, no more medicine should be given, as these were signs of convalescence—proper care as to feeding and management sufficing to complete the cure. Under the influence of regimen, care, and exhibition of the medicine, it was also stated that a cure would be effected in a month or six weeks of the sheep in the early stages of the disease, and in about three months of those in the advanced stages. The recoveries were said to be *all* in the first, and *two-thirds* in the latter stages.

"The exhibition of the medicine for the first fortnight appeared in neither lot to have any marked effect, the animals, with one exception, continuing in their original condition. In the exceptional case alluded to, and which was one of the sheep taking the medicine at the College, the disease was evidently fast gaining ground, foretelling a fatal result.

"On the twenty-first day from the commencement of the experiment this animal died, and on being examined *post mortem* numerous flukes were found in the liver. The organ was pale in colour and had undergone the structural changes commonly met with in rot. Effusion of serum had also taken place into the abdominal cavity, and the entire carcass of the animal was flaccid and paler in colour than is natural from general anæmia, thus proving the true nature of the malady.

"Under these circumstances I resolved to give the medicine to one of the three animals which up to now had not taken any, as the trial did not appear quite satisfactory, death having resulted so soon in the case alluded to.

"Continuing the report of the College sheep, it is next to be observed that the remedy was continued to the middle of June, and this, not only without any apparent benefit, but seemingly with some disadvantage, as each of the three sheep taking the medicine was more emaciated than either of the other two.

"This untoward circumstance evidently depended on the nauseating effects of the medicine, as the animals would often refuse their food for some hours after its exhibition, and sometimes even to the latter part of the day.

"It may be here remarked that the medicine apparently contained some

oleaginous material which had a very unpleasant smell, not unlike fetid animal oil, which had probably to do with its sickening effects.

"On the 20th June, being two months from its first exhibition, the medicine was discontinued to the College sheep. All the animals were kept, however, about six weeks longer, by which time they had become so emaciated that it was determined to destroy them, which was accordingly done. A *post-mortem* examination was made of each, and it was found that no real differences existed in the lesions wrought by the disease in the sheep which had taken the medicine from those of the others which had not. *Living flukes* existed in large numbers in the livers of all the animals.

"To return to the sheep at Oakington. It has been already stated that in this moiety of the animals, for the first fortnight subsequently to April 22, no material alteration had taken place. By the end of May, however, it was very evident that three of the sheep were gaining flesh, and presenting a far more healthy appearance than the others. Two of these were sheep not taking medicine, and one which was. The other three sheep were wasting, and becoming day by day more debilitated; but nevertheless, when compared with those at the College, they were in far better condition.

"On June 6th, forty-five days after the commencement of the experiment, one of the Oakington sheep died, and this, as at the College, was one which had taken the medicine. The lesions met with on examination of the body agreed with those already described, and need not, therefore, to be repeated. The medicine was continued up to the 20th of this month with one of the remaining sheep, and for a fortnight longer with the other—the latter being an emaciated and gradually declining animal.

"The three sheep spoken of as doing well were by this time so much improved that I had little apprehension of their speedy death. The weather was dry and the herbage of the pasture good—circumstances most favourable for their resisting the progress of the malady. All five were kept throughout July, and until the 4th of August, when I determined, as it was evident two would ultimately sink, to kill three of the lot, viz., the two in question together with one of those which had greatly improved in condition, and which had taken no medicine throughout. My chief reason in taking the resolve with reference to the latter named animal, was to ascertain on what its improved state depended, or whether in fact it was the subject of the entozoic disease—rot. On making a *post-mortem* examination of this animal it was found that only a few flukes were present in its liver, and that the structure of the gland was but little changed—facts which fully accounted for its well-doing.

"With reference to the two remaining sheep, one of which had taken the medicine and the other not, I feel assured that their improvement is due entirely to the circumstance that few flukes are present in their livers.

"I have further to report respecting these sheep, that being ewes, I placed them with my breeding flock at the time of putting the rams to the animals, and intend to keep them throughout the winter to mark the result, giving them no more attention as to feeding and management than the flock in general will receive.

"On reviewing all the details of this experiment I fear we must conclude, that this supposed cure of rot in sheep has proved quite ineffective for good in our experience.

(Signed) "JAS. B. SIMONDS."

Subsequently to this report being made to the Royal Agricultural Society one of the two remaining sheep began to give evidences of declining health, particularly by a gradual falling away in condition. This was first observed about mid-winter; but the animal nevertheless lived on and produced a lamb—a

small and weak one—at the end of February. The ewe still survives at the time we write, namely, at the latter part of March, and seemingly may continue for many weeks.

With this report we conclude this section of our subject, and pass on to consider in the next and last place the

Prevention of the Disease.

When investigations into the nature of a disease forbid the hope of its cure, it is indeed most fortunate, should they tend to prove that very much may be done to prevent its occurrence. The old adage rightly teaches that "prevention is better than cure," but the prevention of that which is incurable seems to rise above the proverb itself. Rot when fully established can only be viewed as being incurable; but nevertheless, the knowledge of its cause and nature holds out no faint hope of our being able to prevent it. In times gone by various means for the attainment of this desirable end were suggested, and as some of these have a close connection with those now advocated, we shall follow the course we have adopted throughout these pages, and glean from the early writers on the disease.

Leonard Mascall thus advises,—

> "Against the rot, if you feare your sheepe in wet times, ye shal put them into a house three daies and three nights without meat or drinke. Then give to euery hundredth one bushel of bran mixt with so much salt laid in troffes, and hunger will make them eate it; then driue them to the water and let them drinke their fill. Then let them be chast with a curre a good space after, and put them then into what ground yee will for one quarter, and they shall take no hurt. Then must you take them up the next quarter and serue them so again. Thus must ye vse them foure times in the yeare in doubtfull times, if ye will saue your sheepe from rot."

We can scarcely imagine that even under the pressure of severe hunger sheep would eat anything like the amount of salt here spoken of, viz., presuming the bushel of 1587 to be equal in size to the one in present use. Be this as it may, the proceeding could not be adopted without considerable danger to the lives of the animals, for the quantity of salt would exceed half a pint to each sheep. It is easy, however, to understand the principle here intended to be put into operation, namely, that of producing a quick action on the bowels by the direct irritating effects of the salt, for the purpose of expelling any injurious matters which might be contained within them. This probably was regarded as the chief source of benefit; but then it is to be noticed that Mascall speaks of the security afforded to the animals for the three succeeding months. Immunity, if existing, could only arise from a portion of the solution of salt being absorbed into the general circulation, and exerting its secondary

effects on the secretory organs of the body. The liver would be chiefly concerned in this process; but we imagine that any flukes which might perchance be inhabiting the biliary ducts would escape all injury, and would cling to their habitat with undiminished tenacity.

Considering the importance of the question involved—for we have known *three* ozs. of salt, dissolved in a pint of warm water and given to a sheep *after two days' fasting*, to produce immediate efforts to vomit and speedy death—we have looked closely into the matter, but after considerable research have been unable to arrive at a satisfactory conclusion as to the exact size of the bushel in Mascall's time. It seems by the statutes of Henry III., 1216-72, and also of later kings, to have been enacted that the *gallon* should contain eight troy pounds of dry wheat from the middle of the ear, and that all *ale*, *wine*, and *corn* should be measured by the same gallon, but which nevertheless appears not to have been done—ale and wine being measured each by a different and a *smaller* gallon than corn.

Sir H. Spelman (born 1562, died 1641), and therefore contemporary with Mascall, says that the bushel contains "*four gallons of wine;*" while Dr. Barnard, who was born in 1638, three years before Sir H. Spelman's death, and who wrote on ancient weights and measures, asserts the bushel to be rather more than 59 lbs. *avoirdupois* of common corn (*triticum*), or, allowing for the difference between troy and avoirdupois, to be about double the size named by Spelman.

It further appears that in 1650, the gallon for measuring "*drie things as corne, coals, salt*," &c., contained 272·25 cubic inches, which would give the content of the bushel then in common use as 2178 cubic inches. By the Act of 1697 "The Winchester round bushel was to be eighteen and a half inches in internal diameter, and eight inches deep," thus fixing the gallon at 268·6 cubic inches.

In 1824 the Imperial bushel was fixed at 2218·2 cubic inches, so that it would appear that the bushel of 1650 was intermediate in size between the Winchester and the now Imperial bushel, containing in round numbers about a pint more than the former, and a pint less than the latter; but whether this was the size of the *bushel*, or one of half that capacity, in use in 1587 is not clear.

The weight of salt varies, depending on the amount of its dryness and pulverulent condition; but taking an average specimen of table salt of ordinary dryness, an Imperial bushel will weigh 64 lbs. avoirdupois, while of rough salt, such as in all probability was used in Mascall's time, it will weigh 70 lbs. Putting the weight at the lowest, viz., 64 lbs., merely for the sake

of a position, and making an allowance also for the estimated differences in the sizes of the bushels at the different periods spoken of, we have the enormous quantity of 10·24 ozs. of salt allowed for each sheep; or supposing Sir H. Spelman's statement of the content of bushel—wine—to be correct also with regard to corn and salt, then about half this amount: a quantity which we have shown could not be taken without serious risk to the safety of the animal.

Leaving this question somewhat undetermined, we proceed to quote from other authorities on the prevention of rot.

Gervase Markham, alluding to these means, says:—

"This disease is the cruellest of all other amongst sheepe, and extendeth his violence ouer towneships and countries; and though it be held of most men incureable, yet good gouerment, and this receit I shall deliuer you, will not onely preuent, but preserue your sheepe safe. Therefore as soone as you perceiue that any of your sheepe are tainted, you shall take *Adraces*, which is a certain salt gathered from the salt marshes in the heat of sommer, when the tide going away, and leauing certaine drops of salt water on the grasse, then the violent heat of the sunne turns it to salt: and to speake briefely, all salt made by violence of the sunnes heat onely is taken for *Adraces*, of which there is an infinite store in *Spaine*. With this *Adraces* rubbe the mouthes of all your sheepe once a weeke, and you shall neuer need to fear the rotting of them, for it hath beene well tried; and as I imagine the experiment was found out from this ground. It is a rule, and well knowne at this day in *Lincolneshire* and in *Kent*, that upon the salt marshes sheepe did neuer die of the rot; no other reason being knowne therefore, but the licking up of that salt, and without doubt it is most infallible and most easie."

The allusion made in the foregoing extract to the security given to sheep by placing them on salt marshes is the earliest we have yet met with, and as these remarks were penned in 1614 we have a satisfactory proof of the antiquity of the opinion. Later on we find many authors making mention of the same fact with more or less precision, and some even stating that *affected sheep are cured* by being removed to such pasturage; we shall, however, content ourselves with one other quotation on the subject.

Price, in describing the management of Romney Marsh sheep, says: "I know many acres of pasture land in the marsh which the tide frequently overflows, and sheep are constantly fed upon afterwards. They are fond of feeding upon these wet salts; but more so after a shower of rain. They thrive remarkably well, and *are never known to rot*, though the ground is always saturated with moisture, and the grass has particles of earth adhering to it: two causes which many think produce the rot. Sheep affected with this disease soon die, or recover if put upon this land."

If more evidence be required to show the immunity possessed by sheep thus located, we would turn from our own authors

to those of other countries, where we shall find abundant proofs of the fact. Italian writers are very precise in their statements respecting it, and so also are those of France and Spain. With such a mass of practical and scientific evidence, few persons, we imagine, would have the temerity to deny its truth. It may, however, be rightly asked by all, upon what cause the immunity depends? The answer to the question is both easy and satisfactory. Salt water is destructive to the *cercariæ* of the fluke eggs. These infusorial creatures belong to fresh water, and to this alone. It is here only they can pass through their several gradations when out of the body to fit them for their ultimate development into flukes by entering the digestive organs of sheep. If flukes, however, should have taken up their abode in the biliary ducts prior to the placing of the sheep on salt marshes, they are beyond all reach of harm. The character of the food will have but little effect on the entozoa, and the disease will progress to a fatal termination. The cure spoken of by some authors is only apparent, not real. Sheep, viz., sound ones, " thrive remarkably well," writes Price, when thus located; and we may add, so will many affected animals for a time,—the causes for which need not to be repeated.

That the utility of this change of pasturage to diseased animals is not permanent, we have had many proofs in our own experience, but will cite one only in corroboration. A farmer living in Sussex sent in 1860 a number of rotten sheep to the salt marshes of that county, with a hope of their being cured thereby. For a few weeks the animals improved in condition, thus encouraging his hopes; but very soon they began to waste, and ultimately all succumbed to the disease. Removal to salt marshes as a *preventive* measure is valuable, but as a curative one it is only fallacious. It is, however, a preventive within the reach of but very few persons, and even these may not use it aright. They may keep their sheep at home in early summer, until all the mischief has been done.

The benefit of salt is so universally admitted that we might be content to leave the question without further comment; we shall, however, offer a few additional remarks upon the practical application of this prophylactic agent, but before doing this, we are desirous of recording other supposed means of ancient date of securing sheep against the disease.

Crawshey advises the making of a *malt liquor*, and boiling in it certain herbs, such as shepherd's-purse, comfrey, sage, wormwood, &c., and then to add salt in the proportion of 1¼ lb. to the gallon; and "after Aprill come to give your sheepe seaven or eight spoonefuls a peece, every weeke, once if the weather be wet; if it be dry, you neede not so often; and thus continue till

May and after, as you see cause, according to the drynesse or wetnesse of the weather. If you be carefull to follow this practice," he says, "you shall keepe your sheepe from rot."

Our chief object in giving the above quotation is to show that, as early as the beginning of the seventeenth century, some persons had great fear of a wet spring producing the disease. The placing of the period of danger, however, so early as April, we conceive to be an error; but we agree, nevertheless, if not with the manner, at least with the principle of giving to sheep a saline and saccharine mixture during the continuance of wet weather. The quantity here ordered of salt might possibly be sufficient for good, as a destroyer of the penultimate forms of the fluke, but certainly not that of the malt liquor as a heat-giving element to the body.

Bradley recommends two drachms of powdered juniper-berries to be mixed with a quarter of a pint of sea-salt, and added to a bushel of oats, for feeding sheep in wet weather; and he remarks that where the juniper grows naturally "sheep never are subject to rot."

Few sheep would eat food containing even a small quantity of juniper-berries, and if it were otherwise, we can conceive of no advantage resulting from their use. The observation of sheep being free from rot where the juniper-tree is indigenous seems to us to be putting effects for causes. The plant luxuriates in a dry and sandy district, and in such a soil the cause of rot is not encountered.

Ellis's remarks point to the protective influence, among other things, of the turpentines as existing in the Scotch and other fir-trees, and he recommends their cultivation both "in moist and barren gravelly land." "Sheep," he says, "may be preserved in a great measure from rot by having enough of the loppings of this tree to browse on, for the quality of this evergreen turpentine-tree is hot, dry, and balsamick, and is a purifier of the blood, and an utter enemy to the breed of worms and other insects in the bodies of animals."

After the statements we have made with reference to turpentine when speaking of the treatment of rot, it is unnecessary to comment on this recommendation. We take no objection in the abstract to sheep being allowed to eat of the leaves of the Scotch or other common varieties of fir, but unless far more efficient means are adopted, the disease will not be prevented thereby.

With these selections from the older authors we shall be content. The prophylactic measures which possess the greatest variety have been chosen as examples, and therefore we shall now give our own view of the means which should be adopted. It

is to be remembered that security depends upon the placing of sheep under circumstances which are calculated to *prevent the development of flukes* within their digestive organs. In other words, the encysted *cercariæ* must be either destroyed or expelled the system of the sheep before as perfected distomata they find their way into the biliary ducts. Prevention rests on this foundation alone, when the animals are so located that encysted *cercariæ* are day by day conveyed with the food into their stomachs.

Another and equally sure way of preventing the disease is doubtless to keep the sheep in those situations where, from the nature or improved condition of the soil, these penultimate forms of the fluke have no existence. This, however, cannot be done in many districts, especially in particular seasons; for example, as the summer of 1860. So rife was rot in this year, in consequence of the excessive rainfall, that sheep took the disease on many farms where it had had no existence for a very long time before. Thus we see that in some localities rot is always to be met with, while in others it is only an occasional visitant. It persists in wet and undrained, or it may be in badly-drained land, independent of the state of the weather, becoming, of course, augmented in severity and more rapid in its progress in wet years than in dry.

The improvements which are gradually, but far too slowly, being made by *complete* under-draining will do more on many farms *to prevent* rot than the driest season does now *to retard its progress*, while on certain other farms it will *exterminate* the malady. In this respect under-draining becomes a national question, without reference to any other point, and if the wealth of the country is to be maintained and food preserved to the people, every facility must be given to the effectual removal of all surface-water from our cold, retentive soils. Water must be made to percolate these soils, and yield the nutritive materials it holds in solution to the growing plants, instead of being left as now to stagnate on the surface—weakening vegetation, rotting sheep, and producing rheumatism and ague among our fellow-men.

We speak from long experience in this matter, and also from the woful effects we have observed to attend the want of under-draining in the neighbourhood in which we dwell. The grass-lands of Middlesex, in the so-called Harrow district, the surface soil of which rests immediately on the London clay, are immensely lessened in value from this cause. Here *rot persists*, and here, as a consequence, instead of finding the meadows stocked with large and profitable sheep as meat-producing and wool-growing animals, we see them occupied with Welch and other mountain-

breeds of little or no worth. The grass on two-thirds of many of these farms has also no feeding properties whatever. The hay-making system contributes to the continuance of this sad state of things, and ever must while the produce of six or seven acres is annually carted off the farm into London to bring back manure enough for one.

Let these farms, however, be effectually under-drained, let the impoverished meadows be moderately limed to begin with, let them be subsequently dressed with well-selected artificial manure —and thus made fit for the keeping of better sheep and for the profitable feeding of them with cake and corn—and soon the whole district will wear an altered appearance, and rot be almost unknown.

We cite this condition of a neighbourhood with which we are most familiar, as an example only of what we daily see in our professional travels, and it is not too much to say that were good drainage generally adopted thousands of sheep whose lives are yearly sacrificed to rot and other diseases would be saved to the benefit of the community.

Parkinson has a case so much to the point that we transcribe it. He says :—

"The very farm on which I was born, at Abey Grange, Lincolnshire, was deemed so rotten that the oldest inhabitants advised my father, when he took it, not to keep sheep, but to breed horses and cattle. The greatest portion was a poor, sour, hungry clay, so tenacious as to hold water in most parts like lead ; but when drained properly with open drains, I question if there was a sounder farm in the kingdom. I acted as shepherd four years, and as we killed our own mutton, I officiated as butcher during that time, and also for four years after, but do not remember seeing a single fluke in any one liver. Even during the year when nearly all the sheep in the neighbourhood were rotten, my father lost but seven out of about four hundred on that farm. Therefore it appears certain, that were lands properly drained, they would seldom produce the rot in sheep ; for though water of itself will not occasion the disease, yet on over-moist lands something is bred that will."

It will be observed that Parkinson alludes to open drains, a system now rightly exploded. The allusion, however, is valuable, because if by so imperfect a plan of drainage much benefit was produced, none can doubt that, by a more perfect system, the gain would be far greater to the occupier. In another place we are told that these open drains were often made 2 feet wide and 14 inches deep, so that the loss of land alone must have been considerable.

We may now pass to the other grand principle in preventing this disease, *namely*, that of destroying the immature forms of the fluke after they have entered the stomachs of the sheep. This brings us again to the question of the administration of salt as an effectual agent for this purpose. Its combination with sulphate of iron and aniseed will materially increase its prophylactic

power. Indeed no better medicinal compound for this purpose can be employed than the one named by us when speaking of the treatment of the disease. The daily use of this will not only arrest the last metamorphosis of the *cercariæ*, but destroy the early hatched distomata, and thus remove the cause of the malady. The rules for the exhibition of the medicated food must, however, be modified, as the object sought is somewhat different.

It is almost impossible to reckon upon the time the compound may have to be employed, and therefore care should be taken that no ill effects follow its long-continued use. In a wet year, like 1860, it may be found requisite to commence its use early in June, if not in May, and to continue it to the end of October. Under such circumstances, however, if a moderate quantity only is daily allowed, no possible harm can arise from the medical agents. To meet a difficulty of this kind we would, however, alter the proportion of the medicine to that of the nitrogenised food, by adding to the two bushels of linseed-cake and pea-meal two more bushels of corn. We should prefer *one of crushed oats and another of crushed maize*, to both being of the same kind. Either is good food for sheep, but a mixture of them is better. The relative proportion of the salt and of the other ingredients is thus reduced one-half, thereby enabling the agriculturist to vary the amount of the medicine according to circumstances, but always securing the exhibition of some of it by giving from half a pint to a pint daily of the food-compound, divided or not into two feeds. Provision also is thus made for the nutrition of the animals when the grasses have lost much of their quality, as they invariably have when surcharged with moisture.

A difficulty frequently exists in getting sheep to eat "manger food," especially if mixed with hay-chaff, when the animals are on the pastures during the summer, but this is not insurmountable. Every farm yields at this period of the year some green food, such as tares, clover, Italian rye-grass, &c., a small quantity of which can be daily cut into chaff, with a proportion of hay, for mixing with the other food. Judicious management will surmount every little obstacle, and the result be an ample reward for the care and attention which has been bestowed. If the system be properly carried out we should have little fear of the occurrence of rot, even in the most unpropitious seasons or on land proverbially bad for sheep.

It will be seen that the quantity of salt we have named is much below that which is ordinarily used. No doubt a larger amount may be safely employed, but in our opinion its prophylactic power depends more on its long-continued use than on the largeness of its quantity for a time. A change of weather may call for its complete withdrawal, but, on the contrary, it

may have to be continued throughout the entire summer and autumn. The fondness of animals for salt will lead them to partake readily of an amount which may under certain circumstances be productive of considerable mischief. We would therefore put agriculturists on their guard respecting an abuse of this valuable agent.

Very recently we investigated a case where a number of ewes began suddenly to "cast their lambs" about three weeks before the time of parturition, all of which were dead. The most searching examination into the circumstances of their feeding and management failed at first to throw light on the cause. No objection could be taken to the condition of the animals, their apparent state of health, or to the quality or quantity of their food. Observing, however, at a subsequent date, some of their fæculent matter to be softer and larger in amount than ordinary, and also to contain a little *blood-coloured mucus*, we at once suspected some cause of intestinal irritation, and made a remark accordingly. This drew from the shepherd the expression, "I don't think they are right in their insides, for they drink so much." A clue was obtained; further questioning brought out the fact that several "double handfuls" of salt had been given twice a day with their food for many weeks. We took no objection to this, but requested the shepherd to bring one of the "double handfuls" of which he spoke. This done, we weighed it, and on calculating the quantity, found it to exceed three-fourths of an ounce daily to each sheep.

It immediately occurred to us that the blood of the ewes was so saturated with salt that it was unfitted for the continuance of the life of their lambs, and hence the cause of the premature labours. We forbad entirely the further employment of salt, making no other alteration with reference to the food or management of the animals. As was to be expected, the ewes continued to bring dead lambs for about a fortnight afterwards, when a living one was born. This was followed by others, with an occasional dead one in a state of decomposition from long retention. But the evil was checked, the cause was removed, and the rest of the flock subsequently brought forth an average number of healthy living lambs.

We need add little more respecting the employment of salt in the prevention of rot, except to take objection to the suggestions which have been made to sow it on the land, with a view of destroying the *cercariæ*. If one application of it in a year would do this, even should the herbage suffer for a time, we, perhaps, should not be found to dissent from the practice. But when we remember that the natural history of the *Distoma hepaticum* reveals the fact that brood after brood of *cercariæ* is being pro-

duced from ova, cast daily out of the bodies of rotten sheep, and that the hatching process therefore goes regularly on week by week, we see the necessity for frequent repetitions of salt in the same year, which could not fail to be highly injurious to the pasturage, and also to the soil of the retentive clays, where rot prevails. Repeated small dressings of lime we can conceive to be nearly, if not quite, as efficacious as those of salt in destroying *cercariæ*, and these would stimulate a growth of the better grasses, besides proving of permanent benefit to the soil.

Our province, perhaps, is more with the science of medicine in the treatment and prevention of disease, than with the science or practice of agriculture; but unless some knowledge of the latter accompanies the former, the veterinary pathologist will often fail in detecting the causes of disease, and therefore in rightly suggesting preventive measures. The fundamental principles of preventing the rot of sheep consist, as has been explained, in the destruction of the liver-fluke in one or other of the several stages of its development from the egg to the perfect entozoon, and as an adjuvant to this, the science and practice of agriculture must be brought to bear. Veterinary medicine and agriculture are kindred sciences, and the closer their union, the greater will be the advantage derived by each.

We must not, however, be drawn aside by descanting on an inviting theme of this kind, but rather conclude our exposition of the disease we have been investigating by remarking, that if we would save our sheep from rot, we must thoroughly underdrain our wet lands, and improve the condition of the soil and the quality of the herbage; that we must well protect our sheep in seasons of excessive rainfall; that we must provide for their nutrition by supplying them with a rich and generous diet—flesh-forming and heat-supporting—in proportion to the demands made on the system, and lastly, that we must exhibit those medicinal agents which experience has shown will effect the destruction of the liver-fluke in the earlier stages of its existence, and prior to its entrance into the biliary ducts. These means must be begun early, and not too hastily laid aside. Most of them have also a general application in providing for the well-being of the flock.

Rightly may it be said with the poet of Mantua:—

> "On winter seas we fewer storms behold,
> Than foul diseases, that infect the fold;
> Nor do those ills on single bodies prey,
> But oft'ner bring the nation to decay,
> And sweep the present stock and future hope away." *

* Dryden's translation.

VII.—*The Comparative Advantages of Fixed and Moveable Steam-Power, and of Single or Double Dressing Thrashing-Machines.* By R. Vallentine.

Prize Essay.

The comparative advantages of fixed or moveable steam-power obviously depend very much upon a variety of special circumstances. On large scattered farms, having several sets of outbuildings at which straw would be required, a portable engine will of course be most suitable, if not indispensably necessary; and where steam-cultivation is also to be carried on, there would be a double advantage in the power being moveable. On some large farms, however, having central buildings, in which a great deal of thrashing is done besides grinding, chaff-cutting, &c., so as nearly to occupy an engine, a fixed power will prove most economical, even although steam-cultivation be carried on by a separate moveable power. But generally, where a portable engine can be made fully available for both thrashing and cultivation, the cost of both operations is very much reduced by dividing between them the first outlay and percentage of maintenance, instead of these being all charged to either the corn thrashed or the land cultivated. Instances are numerous where in practice one moveable engine is thus found sufficient for every purpose required. Again, there are many farms provided with two sets of buildings which require a good deal of thrashing at each. In such cases, if letting out for hire be not contemplated, I think a moveable engine with *fixed* thrashing-machines preferable to one moveable machine; since besides other important advantages, to be described afterwards, two fixed thrashing parts cost no more than one portable machine, whilst the cost of maintenance is much less.

Personal experience with every variety of steam thrashing-machine falls to the lot of few, if any; although personal experience of the use of some machines, and the *observation* of others, are possible enough. From all I have seen, and the chief of what I have heard, double-dressing machines, or rather those which are intended for dressing the corn so as to prepare it at once for market, do not succeed. There are times when the corn to be thrashed is of very uniform quality and condition, when a very fair and well-dressed sample may be obtained by blowing out a great deal of offal and light corn, with some that is good; but, as a rule, the attempt to turn out the corn ready for market from the thrashing-machine is attended with loss. With the best engine-driver and the best feeder, there are times when the machinery goes slower than is desirable for driving all the light corn and short straws out of the bulk: it is then impossible to have the

corn in marketable order. Again, the tops and bottoms of stacks are frequently more damp than the middle; the *quality* of the corn in the stack also frequently varies. Under such circumstances it is impossible to obtain an average sample unless the whole is turned into a heap and mixed by subsequent dressing or dressings. There is also an objection to the complexity of most of those machines which are professedly intended to dress and sack up the corn for market. There is always a liability to something going wrong, and however slight the damage or disorder which takes place, the waste of time and labour incidental to frequent short stoppages may be greater than that caused by a long interruption at distant intervals. So liable indeed are some of those complicated machines to get out of order somewhere or other, that in one instance I have known a whole winter to pass over, including many days of thrashing, without the work being kept on regularly for *even one* day free from some vexatious stoppage! Few machines are so very bad as this; but many give great trouble. Moveable double-dressing machines are also less serviceable than single blowers, on account of their increased weight. Some compact 6 horse-power single-dressing thrashing-machines weigh only 45 cwt., whilst some of those huge do-everything machines weigh $3\frac{1}{2}$ tons. There are people to be found who stick so pertinaciously to any favourite of their adoption, that they will contend that steam power is cheaper than hand labour for dressing corn, or indeed any purpose. This corn-dressing is, however, rather a nice operation, and requires more care and discrimination than mere power. A double-dressing machine as a fixture is much to be preferred to portable machines, although it is only rarely that an equal sample can be obtained, especially of wheat, from the machine, without a due mixture of the whole bulk.

A fixed thrashing-machine placed on a loft 8 feet high admits of double-dressing the corn, without the necessity of elevators, revolving screen, or such-like complicated machinery; and although a further hand-dressing may still be necessary, this is much easier done well than when only a single dressing has been effected by power, or a mere separation of the chaff and corn made.

On the great bulk of arable farms, where steam-cultivation is not in progress or contemplated, a fixed steam-engine is comparatively much better than a moveable power. First, the cost of a fixture is less than that of a moveable engine, in the proportion of 3 to 4, according to the prices of the leading makers. A fixed engine costs about 25*l.* per horse-power, whilst a portable engine costs about 33*l.* The price of a fixed thrashing-machine, as compared with a moveable one, is as 1 to 2; fixed thrashing-machines being made by several firms at 8*l.* per horse-power, whilst portable

machines usually cost from 16*l.* to 18*l.* per horse-power. The difference, therefore, in purchasing a fixed or moveable engine, say of 6 or 8 horse power, would stand about thus :—

Fixed Engine and Machine.		*Portable Engine, &c.*	
6 horse-power engine, at 25*l.*	£150	Engine, 6 horse-power, at 33*l.*	£198
Ditto machine, at 8*l.*	48	Machine, at 16*l.*	96
	£198		294
		Deduct cost of fixed engine, &c.	198
		Extra cost of portable engine, &c.	£96

Thus, in round numbers, there is a difference of 100*l.* when the moveable engine, &c., is of 6 horse-power; and the same relative cost holds good for any higher power; although the price per horse-power is less as the size and power are increased. For simplicity of calculation, I shall take the above statement of a 6 horse-power engine for estimating the cost of maintenance. Two years ago I put up a fixed engine on this farm, the working of which, &c., I shall by and by describe. After thrashing out two crops of about 120 acres each, the engine seems as good as new, and has cost nothing whatever for repairs of any kind. I allude to this merely to show that estimates on the cost of maintenance of engines generally cannot be fairly based on personal experience alone. My calculations will, therefore, refer to a number of engines, both fixed and portable, which have been working in various parts of the country for from ten to twenty years. Some of the fixed engines have worked for twenty years, and the portable engines from eight to twelve years. Fixed engines generally require a new boiler every ten or fifteen years, with a small outlay for very moderate repairs and new brasses. The average cost of maintenance for several fixed engines, which have worked about six months in the year, has been about 10 per cent. Portable engines are, however, well known to be extremely costly articles for repairs, and those who have worked them six years and upwards tell me that the cost of maintenance is fully 20 per cent. This seems a high allowance, certainly; but then it is necessary to remember that engines which travel about the country and are in nearly constant work, with rough usage, must suffer more than would be the case with an engine confined to one farm, worked less, and taken more care of. With portable engines there is seldom much cost for repairs for a few years; but, as the saying is, "when once they begin to go, there is no end to their wants." From their construction, however much care be taken of them, they are sure to require more repairs than fixtures. The fire-box, tubes, brasses, &c., wear out sooner, besides being more costly for repairs than the more solid parts of a fixed engine. The estimate

of 20 per cent. for maintenance certainly seems a high one; but as this is the sum stated as barely sufficient by those who have had much experience in the matter, it may be fairly adopted as a basis of calculation. Let us, then, put together the prime cost and the cost of maintenance of the fixed engine, and contrast that sum with the cost of the moveable machinery, so as to show at one glance the comparison between the two:—

Fixed Machinery.		*Moveable Machinery.*	
6 horse-power engine and machine, say	£200	Engine and machine, say ..	£300
Cost of maintenance, at 10 per cent.	20	Cost of maintenance, at 20 per cent.	60
	£220		£360

According to this statement, the relative first cost of a fixed and moveable engine is as 2 to 3, and the relative cost of maintenance as 1 to 3, which shows the great comparative economy of fixed over moveable engines where the one can be substituted for the other. Indeed so great is the difference, that the cost of thrashing on most farms would be more than doubled per year by using a moveable instead of a fixed engine. Those who let out machines for hire do not on an average make large profits, although the number of quarters of corn thrashed in a year necessarily much exceeds the produce of a single farm. This great amount of work, however, must cause a proportionately greater amount of tear and wear than would arise on any ordinary farm. I think, therefore, that such a calculation as 20 per cent. for repairs and depreciation of value must be too much if applied to the work on one farm, unless the engine was kept almost constantly at work in grinding and other tasks besides thrashing.

On any farm where as much as from 300 to 600 quarters of corn is grown, the erection of a fixed engine would be far more economical than hiring. My own farm produces generally from 400 to 600 quarters annually: for several years I hired a 6 horse-power engine and machine to thrash at 1*s.* per quarter. The owner of the machine found an engineer and feeder, who had to be boarded during the thrashing. The engine, which had to be brought an average distance of four miles, weighed with the machine 5½ tons, and required six horses to bring it out of fields and along indifferent roads. The machine sometimes thrashed 40 quarters of reaped wheat a-day, but seldom more than 20 quarters of strong bagged or mown wheat: of barley from 20 to 30 quarters, and of oats from 30 to 50 quarters, per day. There were, however, days lost and parts of days, which materially reduced the average of a day's thrashing throughout the season. So much was this the case, that reckoning every day when the fire was lighted, the average of corn of all kinds, taken together,

thrashed in 20 days, was only 20 quarters. The cost of labour, when thrashing by a moveable machine for several days together, was as follows:—

	£.	s.	d.
1 engineer, board, beer, and lodging	0	2	3
1 feeder, ditto	0	2	3
2 men on stack, wages 2*s.*, beer 3*d.*, at 2*s.* 3*d.*	0	4	6
2 men untying or forking loose corn, at 2*s.* 3*d.*	0	4	6
1 man removing thrashed corn	0	2	3
5 men stacking straw, at 2*s.* 3*d.*	0	11	3
3 boys (1 carrying water for engine, 1 for chaff, 1 for cavings), wages 9*d.*, beer 3*d.*	0	3	0
15	£1	10	0

Where elevators are used for the straw, three men may be dispensed with. A further saving of three hands—one on the stack, another untying, and a lad employed with chaff and cavings—might possibly be effected; but practically, if the work is to be finished in proper style, as many as fifteen hands are required, and it is quite as usual to find that more, rather than fewer, are employed.

Cost of Hired Machine per Day and per Quarter.

	£.	s.	d.
Hire of machine for 20 quarters, at 1s.	1	0	0
15 men and boys, at an average of 2s. per day, including beer	1	10	0
Coal and carriage	0	10	0
	£3	0	0

This is just 3*s.* per quarter, leaving out of account the cost of horses and men in bringing the machine an average distance of four miles, for four days' work or so at a time. The usual calculation, indeed, is that a hired machine costs about 3*l.* 10*s.*, when every expense is included. I shall, however, abide by 3*l.* as nearest to my experience. The cost of thrashing 500 quarters of corn, at 3*s.* per quarter, amounts to 75*l.* In addition to this cost, there was a great deal of extra horse and manual labour incurred by bringing in the straw and cavings to the yard throughout the winter. Thatching was necessary to preserve the straw from getting wet, and with every precaution, there was always much litter and waste in the stackyard which could not be estimated. To clear up the *débris* of the various thrashings, the services of a man with a horse and cart were always necessary for some days, which I have estimated at 5*l.* a-year to the debit of thrashing out of doors. The comparative waste of thrashing in and out of doors cannot be exactly ascertained; but my opinion is that more corn is wasted and spoiled by outdoor than indoor thrashing. If you are caught by rain when taking in to the barn, the stack can be more quickly covered up than when not only that but the machine and some space around it require protection. When a great

number of hands are employed with a portable machine, there is also a temptation to keep on thrashing, although it be not quite fine, or if actually stopped, to resume work quickly again, when wet runs about the stack and has damped the thrashing-machine. He who hires a machine is never certain when he may get it to a day, or sometimes to a week. It may happen that the very day the machine is set down to work, it begins to rain: the machine and hands to work it have come, and if there is any chance of getting on at all, it is the ordinary course to begin. Any one who has a fixed machine may generally choose a promising day for taking in, so as to incur much less liability to interruption than when thrashing for days together with a hired machine.

The natural place for straw is the yard. When a fixture is used, the corn in the straw, together with all the chaff and cavings in one bulk, is brought to the barn in fewer loads than the straw alone, after being thrashed, would make: moreover, two loads of sheaves may be loaded in the same time as one load of loose straw. When the straw is got into the barn adjoining the yards, it is readily carried about by a fork, and that regularly as wanted. When carts are used for conveying the straw, it is very frequently thrown down too thick, and at too long intervals. With a fixed machine, the chaff and cavings are deposited in their proper places, without either a waste of material or labour at all equivalent to that incurred by thrashing in the open air. The fodder for cattle is much more safe from wet and more handy in the barn than out of doors. Even though cattle-men be very careful, still wet must penetrate the stack at times when a cut is made, and damage to the straw must ensue, in addition to waste of labour and a litter in the stackyard. I cannot find that a fixed engine and a fixed thrashing-machine have any drawbacks comparable to those attendant on moveable machines. At first sight thrashing in the field appears to be a quick process, which saves the trouble of moving the unthrashed corn; but before all is done, more labour has been incurred. I once thrashed out 20 acres of barley in the field, and left the straw, chaff, and cavings, according to the usual course, to be brought home at leisure. Having no waggons, a man with a horse and cart was employed nearly all winter for days together to clear up; but, after all, he only made as it were a small hole in a large mountain, which required for its removal a great many carts for several days. The odd man in winter went more times for about perhaps 2 cwt. of chaff at a load, than would have been sufficient to have brought in the whole of the unthrashed corn.

The past two winters I have only required a man for a few days altogether to clear up the refuse thatch in the stackyard. When taking in and thrashing, I now require for a regular full day's

thrashing six men and two boys—one man and boy at the stack, one stout lad emptying carts, one man untying sheaves, one feeder, one man in straw-barn, one engineer, and one boy shovelling corn away from dressing-machine. The engineer or the man who attends to the straw can generally for a minute or two at intervals look to the corn-barn. As, however, two men and a boy would be required to cart in the straw to the yards, if thrashed out of doors, that number of hands may fairly be kept out of the account of cost of thrashing. The number of hands required when the corn is in, then, amounts to four men and one boy, unless, which rarely happens, more than one day's thrashing takes place at a time, when two men are required at the straw. When thrashing out of doors with a hired machine, I found by experience that, including interruptions, the corn thrashed did not average more than 20 quarters per day, but for thrashing indoors an average of 25 quarters may very fairly be taken; because, firstly, you will be more secure from such interruptions; and secondly, because a broken day, instead of being a serious hindrance to the work of the farm, may often be an accommodation, and provide work under cover for hands that would otherwise not find profitable employment:—

Estimate of Cost of Fixed Engine for Thrashing per day and per quarter, allowing 25 quarters per day's thrashing on 20 days a year.

	£.	s.	d.
Interest and depreciation on 200*l.*, at 10 per cent., divided among 20 days	1	0	0
Interest on outlay of 100*l.* for buildings for engine and machine, at 7 per cent., 7*l.*, divided by 20 days	0	7	0
3 men, at 2*s.*; 1 man, at 2*s.* 6*d.*; 1 boy, 6*d.*	0	9	0
6 cwt. coal, with carriage	0	7	0
Oil	0	0	6
	£2	3	6

Total cost 2*l.* 3*s.* 6*d.*, which, divided by 25, gives 1*s.* 9*d.* per quarter.

When thrashing more than a day at a time, the straw requires stacking, and of course more hands to attend to it: two hands untying may also be required in case of very short sheaves, or that loose corn may be properly shaken up. Seven hands are the fewest who can work the machine and take in and thrash at the same time. Four hands only are required to thrash when sufficient corn is in the barn for half a day's thrashing; two hands can take in in a day enough for half a day's thrashing; four hands are required to fill the barn for a whole day's thrashing, when the machine is not going. With a fixture all this may be varied, according to circumstances. In wet days or parts of days a great deal of thrashing may be done when the labourers could be occupied about nothing else.

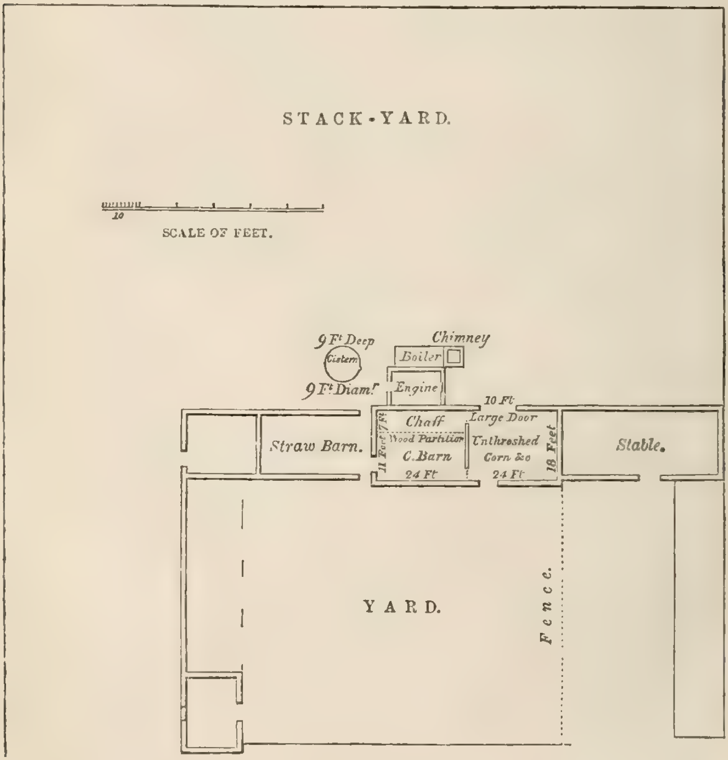
By the hired machine the cost per quarter was about 3*s.*, by

the fixed engine about 1*s.* 9*d.* per quarter, being a saving of 31*l.* 5*s.* on 500 quarters. In this account, be it remarked, the increased labour of cleaning up the stackyard, which is now saved, is not taken into account. An additional advantage is that the straw, chaff, and cavings are kept dry and convenient for use, and though no exact price can be put upon these, I certainly do attach a considerable value to them. My horses have no hay during some months of winter, and eat up chaff, &c., very readily when given fresh. It is certainly anything but economical either of labour or material to waste chaff, and then cut straw to supply its place. The great bulk of practical farmers admit that the chaff of any kind of corn is more nutritious than the straw. Chemical analysis testifies to the same: then why waste chaff as of no use, when ready to hand without cutting? and why waste cavings, which are the most palatable and nutritious of fodder?

The fact is that where there is a fixed machine a few hands can frequently be spared without inconvenience from other labour for thrashing, and sometimes a wet day may be turned to account when nothing else could be done. Two hands with an odd horse may often be spared to take in the matter of 12 or 20 loads of sheaves in a day, which can afterwards be thrashed on any morning or afternoon. When a fixed machine is used, the time of many hands cannot be wasted, as is frequently the case when the locomotive is changed from stack to stack. I like to have long stacks made in short joints for the convenience of taking in one or two parts, as it may happen, in a day. About 15 or 20 cart-loads in a round stack make it a convenient stint for short winter days. My machine thrashes far more than 25 quarters a-day, when worked all day; but not wishing to over-estimate, I have taken this as an average quantity. In thrashing oats, half a day's work often suffices to nearly fill the barn with straw. The expense of raising the steam—about 1*s.*—is of no account compared with the importance of getting the thrashing done when hands are convenient and straw required. I only pay the engineer extra wages when he drives the engine: 6*d.* a-day extra is all the allowance, which amounts to very little in the course of the year; but still it seems to be a sufficient inducement to keep the engine clean and in good order, and to remain half an hour or so after the other workmen leave. Many people pay an engineer higher wages per week throughout the year. This is doubtful policy, and is certainly not economical where only a few weeks' work are required in the year.

By reference to the accompanying sketch, it will be seen that my buildings are well placed with reference to the yards and stacks. When once the straw is in the barn, it is easily moved to the various places where required. My engine and machine of 6 horse-power cost less than 200*l.* when everything was included.

The thrashing-machine, including a shaft which runs from the engine-house into the corn-barn, cost under 40*l*. The maker lived near, and was at no cost for travelling expenses or carriage of materials, &c. Attached to the thrashing-machine is one blower, similar to those generally belonging to portable machines: then from the shaft which extends into the corn-barn another common winnowing-machine is driven by a strap. This machine (which only requires one small bolt to fasten it to the floor) is fed by the corn running down a spout, after being separated by the first blower from the chaff. This arrangement is so simple that there is little chance of anything getting out of order, and generally the corn is very well cleared, but not sufficiently so to be ready for market. Oats for home use, or barley for grinding, require no subsequent dressing. The lower dressing-machine, which is worked by the engine when thrashing, is detached in a moment for dressing by hand.



A circular tank, 9 feet deep and 9 feet in diameter, to receive the soft water from the roofs of the buildings to supply the

engine, was dug and bricked round with common mortar for about 6*l.* The tank holds 4000 gallons, or would do so if full; but a waste-drain, laid nearly a foot below the surface, as is desirable, of course diminishes its capacity. When full, the tank contains enough water to keep the engine going from 12 to 15 days. Practically it has never been nearly empty, as a good fall of rain for 24 hours makes it run over. Soft water is far preferable to common spring water in many respects, and a supply is generally thus more cheaply obtained than by sinking a well. I have already estimated the cost of preparing common farm-buildings for the reception of fixed thrashing-machinery at 100*l.*: such was my own experience.

The annexed sketch shows the size and position of my barns, as now subdivided. A brick partition, one brick thick, has been made between the corn-barn and the compartment for unthrashed corn: a wooden partition runs at right angles to this to divide the lower part of the corn-barn into two divisions, one for chaff and the other for dressed corn; it also serves as a support for the floor above. This floor consists of 8-feet battens, laid without joists or beams, but resting on the aforesaid wooden partition, near the centre, and at either end on a footing of brickwork added to the walls. The thrashing-drum is placed near to the insertion of the brick and wooden partition, and the weight resting on other parts of the loft is not considerable.

The following are the details of the additions and alterations, as made by the landlord:—

Details of Buildings for Engine and Thrashing-machine.

	£.	s.	d.
Chimney 40 feet high, about 7000 bricks, and labour	20	0	0
Engine-house, 13 feet by 15, including fixing of boiler outside	30	0	0
Corn barn-floor, 21 by 11 feet = 231 square feet, at 6*d.* ..	5	15	6
Loft where machine is placed, &c., 21 by 18 feet = 378 feet, at 9*d.*	14	3	6
Chaff-house floor, below, 21 by 7 feet = 147 feet, at 6*d.* ..	3	13	6
Wooden partition between corn-barn and chaff, 21 by 8 feet, = 168 feet, at 6*d.*	4	4	0
Brick partition between corn-barn and unthrashed-corn compartment, 18 by 8 feet = 144 feet, at 6*d.*	3	12	0
Building one brick thick, inside barn, on two sides, to receive the bearing of the battens for loft above, instead of beams, two sides, 21 by 8 feet each = 336 square feet, at 6*d.* ..	8	8	0
Soft-water tank, 9 feet diameter, 9 feet deep; digging out and building with bricks and mortar, at 4*s.* per square yard (capacity of tank about 4000 gallons)	6	0	0
Doors, window in corn-barn, drains, &c., about	5	0	0
	£100	16	6

I likewise had a granary built over the engine-house, 13 by 15

feet, at a cost of about 24*l.* for walls, floor, door, and window, exclusive of the roof, which would of course be required for engine-house, without such addition. This item I have not included in my estimate, because it is not necessarily connected with fixed thrashing-machinery. An engine-house, made as a lean-to, of one brick thick, would cost only about 20*l.*, roof included. A corn-barn, as above, 21 by 11 feet, would contain, when full, about 220 quarters of corn; but practically 50 or 60 quarters is all that can conveniently be held for dressing over and keeping the offal, &c., apart from the dressed and undressed corn.

In conclusion, I would repeat that where a moveable engine could be employed in ploughing as well as in thrashing, there are great temptations to give it the preference; but otherwise the fixed engine is more desirable, since, whether my calculations are nearly correct or not, there can be no doubt that it is far more economical. At the same time when I ordered my fixed machinery, a friend who had some outlying farm premises got a moveable engine, and found it not only more costly but more troublesome to manage. Where such outbuildings exist too distant to be supplied with straw from the chief homestead, I think a fixed thrashing-machine would prove the most economical, even though moveable power should be hired to drive it. A fixed engine might at the same time do the chief part of the work at the home farm.

Having now endeavoured to discuss as fairly as possible the various points connected with this subject, I must leave others to draw their own conclusions whether a moveable or fixed engine will best suit their individual purpose.

Burcott Lodge, Leighton Buzzard.

VIII.—*Cheese Experiments.* By Dr. Augustus Voelcker.

On Pasture Farms, where the milk is not all sold as new milk, nor used for fattening calves, the question arises by what other means it may most profitably be converted into marketable produce, and there is still a choice between four different modes of proceeding.

1. The whole milk may be made into cheese.

2. The cream may be skimmed from part of the milk for making butter, and the skimmed milk added to new milk, and then made into cheese.

3. The whole of the milk may be skimmed and made into skim-milk cheese, and the cream into butter.

4. The whole milk may be skimmed, and made into skim-milk cheese; the cream from the skimmed milk be added to new milk, and made into extra rich cheese.

The question is, which of these four modes gives the best money return. Such a purely practical question can be tested satisfactorily in one way only, that is by actual trials. I therefore gladly availed myself of the kindness of my friend Mr. Thomas Proctor, who most liberally placed his dairy at my command, that I might institute a series of experiments calculated to further the solution of this inquiry. I am, likewise, much indebted to Mr. Tanner for the practical assistance which he rendered me by superintending the experiments, which were made on a sufficiently large scale to furnish reliable data.

For each experimental cheese an equal quantity of milk was used, consisting of 130 quarts of evening milk and 130 quarts of morning milk. The first experimental cheese was made on the 11th of August, 1860; the others on the following days.

In Mr. Proctor's dairy at Wall's Court (now in the occupation of Mr. Richard Stratton) cheese is made in the Cheddar fashion. In making the different experimental cheeses, the same general process was adopted, being that usually employed in this dairy.

Immediately after the morning milking, the evening and morning milks were put together into a Cockey's tin tub, having a jacketed bottom for the admission of steam or cold water.

The temperature of the whole was slowly raised to 80°, by admitting steam into the jacketed bottom. No annatto was used for colouring; after the addition of the necessary quantity of rennet, the tub was covered with a cloth and left for an hour. Rennet, it may be remarked, when properly prepared and added in sufficient quantity, should perfectly coagulate milk at 80° in from three-quarters of an hour to one hour. If the milk fail to be coagulated within the hour, the curd produced will be too tender, and not easily separated from the whey without loss of butter and injury to the quality of the cheese. These results invariably follow when the rennet is not sufficiently strong, or too little of it is employed.

On the other hand, if the curd is completely separated from milk at 80° Fahrenheit in twenty to twenty-five minutes, the cheese produced is apt to be sour or hard. An excess of rennet always has the effect of separating the curd from the milk too rapidly, and in a hard condition.

As much depends upon the strength of the rennet, it is useful in daily practice to prepare a large quantity at a time, and to ascertain by a few trials the proper amount for mixing with a

given quantity of milk. In experimental trials it is absolutely indispensable to know the strength of the rennet, and to employ the same rennet in all the trials. At Wall's Court we took special care to fulfil these conditions.

Our plan of proceeding was as follows:—At about half-past eight o'clock, the curd was partially broken and allowed to subside for about half an hour, after which the temperature was raised very gradually to 108° Fahrenheit, by letting steam into the hollow bottom of the cheese-tub; the curd and whey, meanwhile, being gently stirred with a wire breaker, so that the heat was uniformly distributed, and the curd minutely broken. The heat was kept at 108° for an hour, during which time the stirring was continued; the curd now broken into pieces of the size of a pea was then left for half an hour to settle.

The whey was then drawn off by opening a spigot near the bottom of the tub. As the curd which is obtained by this process is quite tough, it readily separates from the whey, and no pressure whatever is at first requisite to make the bulk of it run off in a perfectly clear state.

The curd collected in one mass was then rapidly cooled and cut across into large slices, turned over once or twice, and left to drain for half an hour. As soon as it was tolerably dry and had cooled down considerably, it was placed under the press and much of the remaining whey removed by pressure. After this the cheese was broken at first coarsely by hand, and then by the curd-mill, which divides it into small fragments. A little salt was then added and thoroughly mingled with the curd.

The next operation was the vatting. The cheese vat, completely filled with the broken and salted curd, was covered with a cloth; the curd was reversed in the cloth, put back into the vat, covered up and placed in the press. The cheese cloth was removed several times, and the cheeses were ready to leave the press on the sixth morning. Mr. Proctor's dairy was furnished with one of Messrs. Cockey's heating apparatus. This apparatus not only maintains a uniform temperature in the room in which the cheese is ripened, but provides a supply of steam, by which the milk and whey may be kept at any temperature that is required; the necessity of removing a large quantity of milk or whey to a boiler to be heated, that it may impart the proper temperature to the remainder of the milk or whey in the cheese-tub, is thus done away with. As the steam is quickly generated, careless dairy-maids sometimes spoil the cheese in a few minutes by allowing the temperature to rise too high. When the curd is overheated, the cheese made from it is always hard and deficient in flavour.

In using Cockey's jacketed cheese-tub, care should also be taken to stir up constantly the contents of the tub when steam is admitted into the false bottom, for the purpose of raising the temperature to about 100°, after the curd has been broken up coarsely. If this precaution is neglected, a portion of the curd adheres to the heated bottom, and melts. The melted curd prevents the equal distribution of the heat, and by not amalgamating with the remaining curd produces a cheese which is not uniform in texture, ripens unequally, and is altogether of an inferior quality. When steam is admitted into the jacketed bottom of the tub, the dairy-maid should not leave her place for a moment, and constantly keep her hands employed in stirring the contents of the tub with the shovel wire-breaker. This is rather hard work, and therefore much better performed by men than by women, many of whom dislike Cockey's cheese-tub. Where it is in use there is, indeed, greater risk of the cheese being spoiled than when whey heated in a boiler is added to raise the contents of an ordinary tub to the required temperature. But it is manifestly unjust to condemn a useful apparatus on account of the mischief which may arise from its misuse.

Cockey's cheese-tub, I have no hesitation in saying, is an excellent apparatus which saves a great deal of labour; but excellent though it may be, I cannot recommend its use to those who cannot place implicit reliance on the care and vigilance of the dairywoman. These women, as a class, are unwilling to alter their plan of operations and learn the use of a new apparatus, which, if it saves much labour, still requires some special attention,—an effort which to some minds seems more troublesome than down-right hard manual labour.

The rennet used in the dairy was made according to the following receipt:—Slice the half of a lemon; sprinkle it with about six ounces of salt, then pour upon it one quart of boiling water; cover the vessel to retain the steam. When cold put into the liquid one fresh vell; allow the whole to stand for two days, then strain the liquid through a fine cloth, and the rennet is ready for use. This quantity is deemed sufficient to coagulate 600 gallons of milk.

Prepared in this mode, and carefully strained off from the sediment which makes its appearance in the course of some days, rennet keeps sweet and efficient for several months.

Experimental Cheese No. 1 (whole-milk Cheese).

A cheese was made from 130 quarts of evening milk and 130 quarts of morning milk, as drawn from the cow. A sample

of the mixed morning and evening milk, on analysis, gave the following results :—

Water	87·30
Butter	3·75
*Casein	3·31
Milk-sugar and extractive matters	4·86
Mineral matters (ash)	·78
	100·00
*Containing nitrogen	·53

The whey obtained in this trial was as clear as Rhenish wine, and contained no suspended curd. It furnished the following analytical results :—

Composition of Whey obtained in making Cheese No. 1.

Water	93·25
Butter	·26
*Albuminous compounds	·91
†Milk-sugar, lactic acid, &c.	4·70
Mineral matters (ash)	·88
	100·00
*Containing nitrogen	·166
†Lactic acid	·60

This whey, though perfectly clear, like all other samples contained in solution a considerable quantity of a curdlike substance, which is not coagulated by rennet, but separates in flakes like the white of eggs when the liquid is raised to the boiling point. In all probability this curdlike substance is albumen. In the analysis of the milk this albuminous compound is given together with casein ; and as it constitutes one-fourth to one-third of the casein mentioned in the analysis of milk, much less curd is obtained as cheese than would be the case if the total quantity of curdlike substances were coagulated by rennet. I have tried various means of separating this curdlike substance together with the rest of the curd, in the hope of obtaining thereby a larger quantity of cheese from a given number of gallons of milk, but have not succeeded. The only simple way of obtaining this substance is to heat the milk or whey nearly to 212 , a temperature which, of course, would altogether spoil the cheese. It has been said that perfectly clear whey possesses little nutritive value, but this is a mistake. Not only does such whey contain nearly the whole of the sugar of milk and bone-producing materials (ash), but also a considerable quantity of albuminous or flesh-producing compounds held in solution, besides some butter, the proportion of which, however, is very small when the operation has been carefully conducted.

On no account, therefore, should the whey be allowed to run to waste. Mixed with a little barley-meal it constitutes the best food that can be given to pigs, for it fattens rapidly and produces the most delicately-flavoured bacon.

In this trial 260 quarts of milk produced 234 quarts of whey.

The cheese was weighed when fresh from the press, and again from time to time with a view to ascertaining the loss which it sustained in keeping. The loss is considerable, as will be seen by the subjoined weighings:

August 17th (fresh from the press)	$61\frac{1}{2}$ lbs.
September 14th	$60\frac{1}{4}$ „
December 14th	$57\frac{3}{4}$ „
February 11th	$57\frac{1}{4}$ „
March 11th	57 „
April 17th	56 „

Total loss in 8 months, $5\frac{1}{2}$ lbs., or 9 per cent. round numbers

This cheese was considered quite ripe on the 14th of December, and therefore lost $1\frac{3}{4}$lbs. after it was ready for the market. A portion analysed on the 17th of April, 1861, gave the following results:

Water	37·85
Butter	28·91
*Casein	25·00
Extractive matters, lactic acid, &c.	4·91
†Mineral matters (ash)	3·33
	100·00
*Containing nitrogen	4·00
†Containing common salt	·52

Experimental Cheese No. 2 (partially skimmed-milk Cheese).

The second cheese was made from 130 quarts of skimmed milk and 130 quarts of new milk. The morning milk stood thirty-six hours, and the evening milk twenty-four hours before being skimmed. The cream removed measured ten pints, and produced 9 lbs. of butter.

A sample of the mixed skim and new milk from which the Cheese No. 2 was made, on analysis gave the following results:

Water	87·89
Butter	3·12
*Casein	2·94
Milk-sugar and extractive matters	5·29
Mineral matters (ash)	·76
	100·00
*Containing nitrogen	·47

The whey produced in this experiment measured 228 gallons, and was found to have the following composition:

Moisture	92·85
Butter	·29
*Albuminous compounds	·93
Milk-sugar, lactic acid, &c.	5·03
†Mineral matters (ash)	·90
	100·00
*Containing nitrogen	·168
†Containing lactic acid	·48

The Cheese No. 2 was made on the 13th of August, 1860, and weighed:

August 21st (fresh from the press)	$50\frac{3}{4}$ lbs.
September 14th	$49\frac{1}{4}$,,
December 14th	47 ,,
March 11th	46 ,,
April 18th	$45\frac{1}{4}$,,
July 30th	44 ,,

Total loss in 8 months, $6\frac{3}{4}$ lbs., or $13\frac{1}{4}$ per cent.
Loss when ready for sale, $3\frac{3}{4}$ lbs., or 7 per cent.

Analysed on the 30th of July, 1861, having been kept rather longer than ten months, it had the following composition:

Water	32·88
Butter	29·25
*Casein	29·87
Extractive matters, lactic acid, &c.	4·92
†Mineral matters (ash)	3·08
	100·00
*Containing nitrogen	4·78
†Containing common salt	·29

Having been kept much longer than the preceding cheese, it contained five per cent. less water and cut rather dry. It will be noticed that this cheese contained very little salt. The dairymaid made a mistake not only in this, but in all the trials, by using an insufficient quantity of salt; not more than about six ounces having been taken for each cheese. The proper quantity of salt is 1 lb. for every 50 lbs. of cheese.

Experimental Cheese No. 3 (skim-milk Cheese).

In this instance 260 quarts of new milk were set aside; the morning milk stood twenty-four hours, and the evening milk thirty-six hours before being skimmed. The milk from which the cream was removed was then made into skimmed-milk

cheese; 260 quarts of milk gave 20 pints of cream, which according to the preceding trial would have yielded 18 lbs. of butter.

A sample of the skimmed milk from which the Cheese No. 3 was made, on analysis furnished the following results:

Water	89·00
Butter	1·93
*Casein	3·01
Milk-sugar and extractive matters	5·28
Mineral matters (ash)	·78
	100·00
*Containing nitrogen	·48

The whey in this experiment measured 222 quarts, and had the following composition:

Water	93·15
Butter	·14
Albuminous compounds	·91
*Milk-sugar, lactic acid, &c.	5·06
Mineral matters (ash)	·74
	100·00
*Containing lactic acid	·48

The Cheese No. 3 was made on 15th of August, and weighed:

August 21st (fresh from the press)	48½ lbs.
September 14th	47 ,,
December 14th	44 ,,
February 11th	43½ ,,
March 11th	43½ ,,
April 18th	42 ,,

Total loss in 8 months, 6½ lbs., or 13 per cent.
Loss when ready for sale, 4½ lbs., or 9¼ per cent.

A portion of this cheese was analysed on the 18th of April, 1861, and found to consist in 100 parts of—

Water	39·43
Butter	27 08
*Casein	30·37
Extractive matters and lactic acid	·22
†Mineral matters (ash)	2·90
	100·00
*Containing nitrogen	4·86
†Containing common salt	·23

Experimental Cheese No. 4. (extra-rich Cheese).

The cream from 260 quarts of milk was added to 260 quarts of new milk and made into cheese. A sample of the mixed

cream and new milk from which No. 4 was made contained in 100 parts:

Water	85·75
Butter	6·11
*Casein	2·94
Milk-sugar and extractive matters	4·47
Mineral matters (ash)	·73
	100·00
*Containing nitrogen	·47

In this trial 243 quarts of whey were produced. The following is an analysis of the whey obtained in making Cheese No. 4:

Water	92·95
Butter	·65
Albuminous compounds	1·20
*Milk-sugar and lactic acid	4·55
Mineral matters (ash)	·65
	100·00
*Containing lactic acid	·48

In comparison with the whey obtained in making the Cheeses No. 1, 2, and 3, this whey is richer in butter and also in albuminous matter. It was rather milky, and owed its turbid condition to finely suspended particles of curd and butter.

The Cheese No. 4 was made on the 15th of May, 1860, and weighed:

August 21st (when it left the press)	70¾ lbs.
September 14th	70 „
December 14th	67 „
February 11th	66 „
March 11th	66 „
April 18th	64 „
July 30th	62 „

Total loss in 11 months, 8¾ lbs., or 12½ per cent. in round numbers.
Loss when ready for sale, 3¾ lbs., or 5 per cent.

Composition of extra-rich Cheese, No. 4, on July 30th, 1861.

Water	30·53
Butter	41·58
*Casein	23·38
Extractive matters, lactic acid, &c.	2·45
†Mineral matters (ash)	2·06
	100·00
*Containing nitrogen	3·74
†Containing common salt	·09

It was considered desirable to repeat these trials, and to make four other cheeses precisely in the same way in which the preceding four cheeses were made respectively.

Cheese No. 5 (whole-milk Cheese).

Made from 260 quarts of new milk.

Composition of this Milk (*August* 21*st*, 1860).

Water	87·00
Butter	3·99
*Casein	3·44
Milk-sugar, extractive matter, &c.	4·81
Mineral matters (ash)	·76
	100·00
*Containing nitrogen	·55

This milk, it will be seen, differs but slightly in composition from that used on the 11th of August, for making whole-milk cheese.

Composition of Whey from Cheese No. 5.

Water	92·80
Butter	·59
Albuminous compounds	·91
Milk-sugar, lactic acid, &c.	5·04
Mineral matters (ash)	·66
	100·00

This whey, like that made from Cheese No. 4, was not sufficiently clear, and contained too much fatty matter in a state of mechanical suspension.

The Cheese No. 5 was made on 21st of August, and weighed:

August 27th (fresh from the press)	$61\frac{1}{2}$ lbs.
September 14th	$60\frac{3}{4}$,,
December 14th	$58\frac{1}{4}$,,
March 11th	57 ,,

Total loss in $6\frac{1}{2}$ months, $4\frac{1}{2}$ lbs., or $7\frac{1}{4}$ per cent.
Loss when ready for sale, $3\frac{1}{4}$ lbs., or $5\frac{1}{4}$ per cent.

Composition of Cheese No. 5 *on the* 11*th July*, 1861.

Water	31·70
Butter	36·18
*Casein	27·19
Extractive matters, lactic acid, &c.	1·95
†Mineral matters (ash)	2·98
	100·00
*Containing nitrogen	4·35
†Containing common salt	·34

Cheese No. 6 (partially-skimmed-milk Cheese).

Made from 130 quarts of new milk and 130 quarts of skimmed milk.

Composition of Milk from which Cheese No. 6 was made.

Water	88·50
Butter	2·43
*Casein	3·25
Milk-sugar, extractive matters, &c.	5·03
Mineral matters (ash)	·79
	100·00
*Containing nitrogen	·52

Ten pints of cream were taken from 130 quarts of milk, and produced 9¼lbs. of butter.

Composition of Whey from Cheese No. 6.

Water	93·05
Butter	·40
Albuminous compounds	·95
Milk-sugar, lactic acid, &c.	4·96
Mineral matters (ash)	·64
	100·00

This cheese was made on the 18th of August, and weighed:

August 24th	53 lbs.
September 14th	52¼ ,,
December 14th	49¾ ,,
February 11th	49 ,,

Total loss in 6 months, 4 lbs., or 7½ per cent.
Loss when ready for sale, 3¼ lbs., or 6 per cent.

Composition of Cheese No. 6, analysed April 22nd, 1862.

Water	38·43
Butter	23·28
*Casein	32·37
Extractive matters, lactic acid, &c.	2·10
†Mineral matters (ash)	3·82
	100·00
*Containing nitrogen	5·18
†Containing salt	·65

Cheese No. 7 (skimmed-milk Cheese).

Made from 260 quarts of milk, from which the cream (20¼ pints) was taken off.

Composition of Skim-milk used in making the Cheese No. 7.

Water	89·10
Butter	2·31
*Casein	3·50
Milk-sugar and extractive matters	4·32
Mineral matters (ash)	·77
	100·00
*Containing nitrogen	·56

The whey from this cheese was perfectly clear, and contained hardly any butter, as will be seen by the subjoined analysis:

Composition of Whey from Cheese No. 7.

Water	93·10
Butter	·14
Albuminous compounds	·76
*Milk-sugar and lactic acid	5·31
Mineral matters (ash)	·69
	100·00
*Containing lactic acid	·46

This cheese was made on the 20th of August, 1860, and weighed:

August 26th	49¾ lbs.
September 14th	49 ,,
December 14th	47½ ,,
March 6th	46½ ,,

Total loss in 6 months, 3¼ lbs., or 6½ per cent.
Loss when ready for sale, 2½ lbs., or 5 per cent.

Composition of Cheese No. 7 (*Skim-milk Cheese*).

Water	38·39
Butter	23·21
*Casein	28·37
Extractive matters, lactic acid, &c.	6·80
Mineral matters (ash)	3·23
	100·00
*Containing	4·54

Cheese No. 8 (extra-rich Cheese).

Made from 260 quarts of new milk, to which was added the cream (20 pints) from 260 quarts of milk.

Composition of the Milk from which the Cheese No. 8 *was made.*

Water	86·73
Butter	4·81
*Casein	2·69
Milk-sugar and extractive matters	5·01
Mineral matters (ash)	·76
	100·00
*Containing nitrogen	·43

Composition of the Whey from Cheese No. 8.

Water	92·95
Butter	·42
Albuminous compounds	1·01
Milk-sugar, lactic acid, &c.	4·95
Mineral matters (ash)	·67
	100·00

This cheese was made on the 20th of August, 1860, and weighed:

August 26th (fresh from the press)	$74\frac{3}{4}$ lbs.
September 14th	$73\frac{1}{2}$,,
December 14th	71 ,,

Loss from the time it left the press until ready for sale, $3\frac{3}{4}$ lbs., or 5 per cent.

No analysis was made of this cheese.

These experiments then led to the following results:

	Quarts.		Marketable Cheese. lbs.	Butter. lbs.
1.	520	of milk produced .. .. .. (whole-milk)	116 ..	..
2.	,,	(one-half skimmed) produced	$96\frac{3}{4}$ ..	18
3.	,,	(all skimmed) produced	$90\frac{1}{2}$ ..	36
4.	1040 ,,	{the cream from one-half being added to the other .. ..} produced {skim cheese / rich cheese}	$90\frac{1}{2}$ / 138 ..	..

The cheeses were sent to Messrs. Bridges and Co., extensive cheese-factors at Bristol, who considered No. 1 to be worth 70*s.* per cwt.; No. 2, 60*s.* per cwt.; No. 3, 50*s.* per cwt.

With respect to the extra-rich Cheese No. 4, Messrs. Bridges say: "We have examined the cheese marked No. 4: we think it cuts rather richer than that marked No. 1, but it bears no higher value in the market." In my paper on the 'Composition of Cheese,' I pointed out the fact that the market value of cheese does not entirely depend upon the amount of butter which it contains. I am glad to find this opinion confirmed by the testimony of a cheese-factor whose practical knowledge is extensive.

Mr. Tanner informs me that he has had a long conversation with Mr. Bridges on the subject of cheesemaking, and in his letter to me quotes several observations made by him on this occasion, which perfectly accord with remarks made by me in the paper referred to.

Thus Mr. Bridges, speaking within certain limits, considers the richness of cheese to depend as much upon the mode of making as upon the quantity of cream in the milk. Too much heat, he says, destroys the cream; meaning, no doubt, that too much heat melts some of the butter which then passes into the whey. By carelessly manipulating the tender curd, he justly observes, some of the cream may be washed out and passed into the whey. This gentleman is also of opinion that the best Cheddar cheese can be made from good new milk, and therefore considers the addition of cream to milk of questionable service, and certainly an extravagant practice.

The addition of cream to new milk, no doubt, if not absolutely necessary, certainly improves the quality of Stilton cheese, but

the market value of Cheddar is not raised materially by such an addition. First-rate cheesemakers, Mr. Bridges observes, often take some cream from the milk, and still make a superior quality of cheese (worth more in the market) than less experienced and careless makers produce from unskimmed milk. He looks upon the temperature and the careful breaking of the curd as the points upon which the quality of the cheese (Cheddar) mainly depends —apart, of course, from the influence of the natural richness or poverty of the milk.

Having treated of all these points in detail in my paper on the 'Composition of Cheese,' I need not refer to them in particular. These observations made by Mr. Bridges must be satisfactory to dairymen, as affording a practical confirmation of the correctness of opinions which I have already published, as resulting from my own observations and scientific experiments.

The cheeses produced in these trials were not so good as they might have been, nor like those of experienced makers, such as Mr. Harding of Marksbury, Mr. McAdam of Gorsty Hill, or Mr. Chandos Pole of Derby. Anxious not in any way to thwart or disconcert the dairymaid, I thought it wise to let her have entirely her own way. She certainly made two great mistakes. To one I have already alluded: six ounces of salt is not enough for from 50 to 60 lbs. of cheese; three-quarters to one pound would have been a better proportion. The second mistake which she made was to raise the temperature to 108° F. On no account should the heat of the cheese-tub be allowed to rise above 100° F. The higher the temperature is raised the more readily the whey passes from the curd, and the less mechanical work is required. The dairywoman may, therefore, be naturally tempted to save herself trouble to the injury of the cheese.

Although I am a great advocate for the Cheddar system of cheesemaking, I am bound to say that the comparatively lower temperature which the best Cheshire makers adopt is the main reason of the exceedingly fine aroma which so favourably characterises their produce.

The finest-flavoured cheese which I ever tasted was made at Ridley Hall, near Crewe, Cheshire. I have no hesitation in saying that milk of the same quality as that which there came under the careful management of Mrs. Willis, in the hands of the most expert Cheddar maker would not produce a cheese of an equally delicious flavour.

The care, skill, and enormous amount of work and time which the making of the best Cheshire entails, especially when contrasted with the Cheddar system, no doubt are the main causes why so little really first-rate Cheshire cheese is now manufactured. I would strongly recommend those who prefer in the main to follow

the Cheshire plan, but find that their cheese is apt to heave and be inferior in quality, to set the milk at a somewhat higher temperature than is their custom; 80° is a very good temperature at the time of applying the rennet. When the curd has been carefully broken up and allowed to settle for about half an hour, the temperature of the cheese-tub may then be raised with advantage to 90° F.

Returning to the Wall's Court cheese-trials, it appears, according to preceding data, that 1000 gallons of milk, used according to the four different modes adopted, gave market produce as follows:

No. 1. 1000 gallons of new milk gave 8 cwts. of whole-milk cheese.
No. 2. 1000 gallons of milk, partially skimmed, produced 6½ cwts. 16 lbs. of cheese, and 1¼ cwt. of butter.
No. 3. 1000 gallons of milk, skimmed, produced 6 cwts. 24 lbs. of skim-milk cheese, and 2½ cwts. of butter.
No. 4. 1000 gallons of milk produced 3 cwts. 12 lbs. of skim-milk cheese, and 4¾ cwts. of extra-rich cheese.

Let us now compare the economic results obtained, taking as the basis of our calculation the price actually obtained by the sale of these eight large Cheddar cheeses, and assuming that butter is sold at 1*s*. a pound:

		£.	s.	d.	£.	s.	d.
No. 1.	Produced 8 cwts. of whole-milk cheese, worth 70s. per cwt.	..	..		28	0	0
No. 2.	Cheese, 6 cwts. 2 qrs. 16 lbs., at 60s. per cwt.	19	18	4			
	Butter, 1¼ cwt., at 1s. per lb.	7	0	0			
					26	18	4
No. 3.	Cheese, 6 cwts. 24 lbs., at 50s. per cwt. ..	15	10	8			
	Butter, 2½ cwts.	14	0	0			
					29	10	8
No. 4.	Made into skim-milk cheese and extra-rich cheese. 1000 gallons of milk produced—						
	Skim-milk cheese, 3 cwts. 12 lbs., at 50s.	7	15	4			
	Rich cheese, 4 cwts. 3 qrs., at 70s.	16	12	6			
					24	7	10

Thus in these experiments, it will appear that No. 2 gave the best, and No. 4 decidedly the least profitable, result. Where a ready sale for butter can be found, I am inclined to think it is more profitable to make skim-milk cheese and butter than to look only to the production of a cheese of a better quality. The Cheddar plan, however, is not so well adapted for the making of skim-milk cheese as the Gloucestershire system, neither is it desirable to make thick skim-cheeses. A thick skim-milk cheese, when made at the elevated temperature at which Cheddar is usually produced, never ripens properly, and like all skim-milk cheeses deteriorates when kept more than two months; whereas a rich Cheddar is gradually improved by keeping for many months.

Cheese Experiments made at Mr. Harrison's Dairy, Frocester Court, Stonehouse.

Mr. J. F. Harrison makes excellent uncoloured single Gloucester, and follows the ordinary practice in his neighbourhood of making cheese twice a day.

The pasture in this district is good, but full of buttercups (*Ranunculus*). The cows kept on this pasture yield milk rich in butter. In making single-Gloucester, a portion of the milk from each milking is generally set aside, partially skimmed, and then added to new milk. The rennet is applied at a temperature varying, according to the time of the year, from 75° to 80°. After an hour the curd is carefully cut across with a large-bladed knife, then removed by a skimming dish from the sides and bottom of the tub. The curd is allowed to subside for about a quarter of an hour, after which the clear whey is dipped out with a wooden bowl, care being taken not to press or injure the tender curd. When most of the whey has been removed, the curd is again carefully stirred with a wooden skimming dish, and afterwards with a wire-breaker, at first very cautiously and gradually more briskly. After the curd has been thoroughly broken, the whole is left to settle for twenty or twenty-five minutes; the clear whey is next drawn off, and the curd collected into one mass. This is cut into thin slices, which are heaped up and again collected into one mass, and this process of slicing and heaping is repeated several times, as it materially facilitates the separation of the whey, and is much preferable to the use of pressure. Many dairymaids, anxious to be rid of this work, put the curd far too soon into the presses; in consequence of which the pores of the outside layers of the cheese are completely closed up, and the whey prevented from escaping. No amount of ordinary pressure removes the whey so perfectly as repeated slicing and careful breaking up.

When sufficiently firm and dry, the curd is placed upon cloth in the vat, and gently pressed under an ordinary cheese-press. When no more whey flows out, it is removed from the press, crumbled coarsely by hand, and then more minutely by the curd-mill. Finally the curd is vatted, and placed at first under a slight pressure, which is gradually increased. The last thing done on the day on which the cheeses are made, is often to rub in some salt. Subsequently the cheeses are salted in the same way three times, and each time the salt is rubbed in, a clean and dry cloth is placed round the cheeses. In about a week's time the cheeses are ready to be removed to the cheese-room.

The preceding is a short description of the usual plan of making thin Gloucester cheese.

Mr. Harrison does not colour his cheese, and keeps it for about a fortnight in a warm room, and then removes it to a cool,

airy shed for three weeks longer before he sends it to market. In both rooms the cheeses are kept on wooden shelves and frequently turned. In winter the first room is heated by a stove.

Mr. Harrison, who takes great interest in cheesemaking, some years ago applied the ordinary centrifugal drying-machine to the purpose of separating whey. A small turbine or water-wheel drives the revolving vessel in which the curd is placed in a cloth. As the vessel attains its velocity, the whey is driven outwards through the perforated surface which encloses it, and escapes. The curd in this case is either not broken at all, unless by accident, or but imperfectly.

Having operated with the drying machine, I am of opinion that instead of beating curd and whey together into the revolving vessel, it would be better and more expeditious to break the curd coarsely, to let it subside for twenty minutes, to dip out as much of the clear whey as possible without disturbing the curd, and then to place it tied in a cloth in the revolving vessel.

Mr. Harrison obligingly placed his dairy at my disposal to try certain experiments, and for his kindness and personal assistance my sincere thanks are due to this gentleman.

It has been stated by many that in cheesemaking a considerable loss both in curd and butter is often incurred by adopting a faulty method, or by careless manipulation. With a view of preventing these alleged losses, Mr. Harrison was the first to adapt the centrifugal drying-machine to dairy operations. But as his excellent dairymaid prefers to make cheese by hand, the centrifugal machine is not often set in motion at Frocester Court.

I was anxious to ascertain by comparative trials whether the alleged loss in cheesemaking was unavoidable, or whether it could be avoided or diminished by the employment of this centrifugal whey-separating machine. The trials were made at Frocester Court on the 7th of August, 1860.

No. 1.—In the first experiments, 80 gallons of milk were made according to the usual plan into four cheeses, which may be called hand-made cheeses.

No. 2.—In the second trial, 80 gallons of milk were made into four cheeses as before, with this exception—that the whey was separated by the centrifugal machine.

The milk used in both trials had the following composition:

Water	87·40
Butter	3·43
*Casein	3·12
Milk-sugar, extractive matters, &c.	5·12
Mineral matters (ash)	·93
	100·00
*Containing nitrogen	·50

The whey obtained in each experiment was nearly clear; that

produced by the machine being the clearer of the two. On analysis the following results were obtained:

Composition of two Samples of Whey made at Frocester Court, August 7th, 1860.

	Machine-made.	Hand-made.
Water	92·75	92·60
Butter	·39	·55
*Albuminous compounds	·87	·96
Ash	·86	·81
Sugar and extractive matters	5·13	5·08
	100·00	100·00
*Containing nitrogen	·14	·15
Free lactic acid	·41	·36

We see then that both in respect of the butter and the albuminous compounds left in the whey, the machine has an advantage, though but a slight one; but there is no essential difference between ordinary whey and that produced by the centrifugal machine. Other samples of whey from cheese made by hand have given me quite as little butter as that found in the whey produced by the machine; and every sample of whey which I have yet examined contained from 8-10ths to 1 per cent. of a curdlike albuminous matter which is not coagulated by rennet, and that can only be separated by boiling.

The four cheeses of each trial were carefully marked and weighed at intervals. They were made, it will be remembered, on the 7th of August.

No. I.—The cheeses made by hand weighed:

August 18th	81½ lbs.
September 3rd	78½ „
September 22nd	75 „

Loss in 4 weeks, 6½ lbs., or 8 per cent.

II.—The four cheeses made by the machine weighed:

August 18th	74½ lbs.
September 3rd	70½ „
September 22nd	67 „

Loss in 4 weeks, 7½ lbs., or 10 per cent.

The cheese was sold at 7*d.* a pound when only five weeks old, and no perceptible difference in the quality of the cheese made by hand and that made by the machine could be noticed. All were equally good and fine-flavoured cheeses.

Eighty gallons of milk when made by hand into cheese thus produced 75 lbs., and when made by the machine only 67 lbs. of saleable cheese. Since the whey from the machine-made cheese was rather the poorer, fully as great a weight of cheese might have been expected when the machine was used as when the ordinary plan of manipulation was adopted. To account for this

difference of 8 lbs. it may be supposed that the machine-made cheese was drier than the other; but the preceding weighings show that whereas the No. I. cheeses lost in four weeks only 8 per cent. in weight, the No. II. cheeses made by machine lost 10 per cent., indicating thereby that the latter were more moist than the former. Direct determinations indeed showed that the machine-made cheese contained rather more water than that made in the ordinary way. In the former I found 37·20 per cent. and in the latter 36·77 per cent. of water; but this difference is not sufficient to account for the results.

The case was puzzling; equal quantities of milk had in each case been carefully measured out; rather less matter had been left in the whey which came from the machine; the cheese differed but little in respect of moisture; but for an accidental observation I should have been completely at a loss to explain the anomaly. I found out by chance that the dairymaid was determined not to be beaten by the machine, and to prove her skill by making a larger quantity by hand than by the machine. The two trials were made in two adjoining rooms, and watching the making of the two sets of cheese from beginning to end, I found the dairymaid in the act of incorporating some cheese-parings from the preceding day's make with the hand-made cheese. Whether these parings were specially reserved for the coming trial or not I cannot say; but I certainly saw her take them from a tolerably large supply which she kept under the cheese-tub.

The examination of the two samples of whey had, however, in my opinion afforded sufficient evidence of the fact that no matter how cheese is made, a considerable proportion of the nitrogenized compounds of milk is left in the whey; and that this loss is unavoidable, and not necessarily greater in the ordinary plans of operation than by the use of a machine.

All the experimental cheeses were received by me on the 28th of September, 1860.

One of them which was made by the machine got injured in the transmission from the dairy to Cirencester. It weighed 16½ lbs. A portion of the cheese was analysed on the 28th of September, and yielded the following results:

Water	37·20
Butter	27·30
*Casein	24·50
Extractive matters, lactic acid, &c.	7·44
†Mineral matters (ash)	3·56
	100·00

*Containing nitrogen	3·92
†Containing common salt	·85

The cheeses were kept for a considerable length of time,

principally for the purpose of ascertaining the loss in weight which they sustained in keeping.

On the 28th of September the eight cheeses weighed:

No.	Machine-made. lbs.	No.	Hand-made. lbs.
1	$16\frac{1}{2}$	1	$18\frac{3}{4}$
2	$17\frac{1}{4}$	2	17
3	$16\frac{1}{4}$	3	$18\frac{3}{4}$
4	$16\frac{1}{2}$	4	$20\frac{1}{4}$
Total	$66\frac{1}{2}$	Total	$74\frac{3}{4}$

On the 9th of November they weighed:

No.	Machine-made. lbs.	Loss since 28th Sept. lbs.	No.	Hand-made. lbs.	Loss since 28th Sept. lbs.
1	$15\frac{3}{4}$	$\frac{3}{4}$	1	$18\frac{1}{4}$	$\frac{1}{2}$
2	$16\frac{3}{4}$	$\frac{1}{2}$	2	$16\frac{1}{4}$	$\frac{3}{4}$
3	$15\frac{3}{4}$	$\frac{1}{2}$	3	$18\frac{1}{4}$	$\frac{1}{2}$
4 Consumed.			4	$19\frac{3}{4}$	$\frac{1}{2}$

Weights on the 19th of January, 1861:

No.	Machine-made. lbs.	Loss since 28th Sept. lbs.	No.	Hand-made. lbs.	Loss since 28th Sept. lbs.
1	14	$2\frac{1}{2}$	1	$16\frac{3}{4}$	2
2	15	$2\frac{1}{4}$	2 Consumed on the 9th Nov.		
3	$14\frac{1}{4}$	$2\frac{1}{4}$	3	$16\frac{1}{2}$	$2\frac{1}{4}$
4 Consumed.			4	$18\frac{1}{4}$	2

Weights on the 12th of February, 1861:

No.	Machine-made. lbs.	Loss since 28th Sept. lbs.	No.	Hand-made. lbs.	Loss since 28th Sept. lbs.
1	$13\frac{3}{4}$	$2\frac{3}{4}$	1 Consumed.		
2	$14\frac{3}{4}$	$2\frac{1}{2}$	2 Consumed.		
3	14	$2\frac{1}{2}$	3	16	$2\frac{3}{4}$
4 Consumed.			4	$17\frac{3}{4}$	$2\frac{1}{2}$

Accordingly $42\frac{1}{2}$ lbs. of machine-made cheese lost from the time they were ready for sale until the 12th of February—that is a period of not quite five months—$7\frac{3}{4}$ lbs., or 18 per cent.; whilst $33\frac{3}{4}$ lbs. of the hand-made cheese lost in the same period $5\frac{1}{4}$ lbs. or $15\frac{1}{2}$ per cent.: thus showing plainly that the hand-made cheeses were rather drier than those made by the machine. These weighings likewise show the economy of selling cheese as soon as possible after it is ready for the market.

One of the cheeses made by hand was analysed on the 21st of January, 1861, and found to contain in 100 parts:

Water	31·96
Butter	31·37
*Casein	29·37
Extractive matters, lactic acid, &c.	2·85
†Mineral matters (ash)	4·45
	100·00

*Containing nitrogen	4·70
†Containing common salt	1·35

During the time of keeping, it became, of course, drier and correspondingly richer in butter.

Two skim-cheeses made on the 8th of August, 1860, weighed on the 18th of August, 31½ lbs.; on the 3rd September, 30 lbs.; and on the 22nd September, 28 lbs., and were then considered ready for sale. Kept still longer they lost considerably in weight, as will be seen by the following weighings:—

Weight of Two Skim Cheeses.

No.	September 28th.	November 9th.	January 19th, 1861.	February 12th, 1861.
	lbs.	lbs.	lbs.	lbs.
1	13	12½	11½	11
2	15	14½	13¼	12¾
Total	28	27	24¾	23¾

Total loss in weight in not quite 5 months, 4¼ lbs., or 15 per cent.

A portion of one of the skim-cheeses was analysed on the 19th of February, 1861, with the following results:

Water	27·68
Butter	30·80
*Casein	35·12
Extractive matters, lactic acid, &c.	1·46
†Mineral matters (ash)	4·94
	100·00
*Containing nitrogen	6·62
†Containing common salt	1·27

This cheese was hardly inferior to a good whole-milk cheese, and might have readily been sold as such.

It is a well-ascertained fact that towards the fall of the year, cows produce much less but much richer milk than in spring and summer. This is strikingly illustrated by the various quantities of cheese which are obtained at different times of the year, from a given quantity of milk, as will be seen by the following results with which Mr. Harrison kindly supplied me:

In the beginning of August, 160 gallons of milk produced 8 cheeses, weighing on the 22nd of September 142 lbs.

On the 19th of October, 110 gallons produced 7 cheeses, weighing on the 31st of December 108½ lbs.

On the 29th of November, 60 gallons of milk produced 5 cheeses, weighing 70 lbs. on the 13th of February.

On the 29th of November the cows were still out at grass, and had no extra food but hay.

In conclusion I may mention an experiment which Mr. Harding, of Marksbury, made at my request, with a view of converting, if possible, into cheese the curdlike substance which is not coagulated by rennet, together with any suspended particles of butter usually occurring in whey.

To this end 70 gallons of whey were heated to the boiling point, and kept for some time at that temperature. The curdlike substance which separated was collected on a cloth, and after the addition of a little salt, placed in the cheese-press. After remaining in it for three days 18 ounces of whey-cheese were obtained. This cheese had a peculiar granular texture, and even after long keeping did not ripen properly like other cheese. The high temperature at which it was produced evidently prevents the necessary fermentation which curd must undergo before it becomes mellow, and saleable as human food.

The small quantity of 18 ounces from 70 gallons, moreover, appears hardly sufficient to repay for the trouble. On the whole it would appear to be quite as profitable to set the whey for butter, and to give the skimmed whey to the pigs.

As a matter of curiosity I append an analysis of the whey-cheese, which, although very rich in fatty matters, had a bad texture and quite an inferior flavour.

Composition of Whey Cheese.

Moisture	30·23
Butter	44·27
*Casein	21·50
Extractive matters, lactic acid	1·52
†Mineral matters (ash)	2·48
	100·00
*Containing nitrogen	3·44
†Containing common salt	1·83

IX.—*Supplementary Report of Experiments on the Feeding of Sheep.* By J. B. Lawes, F.R.S., F.C.S., and Dr. J. H. Gilbert, F.R.S., F.C.S.

In the last volume of this Journal we stated our intention to enter, on an early occasion, upon the consideration of the composition of the *manure* of fattening animals, in relation to that of the food they consumed. For many years past we have been accumulating experimental evidence on this very important and difficult subject of inquiry; and it was with a view to an extension of our results, prior to publication, that the experiments which constitute the subject of the present short report were arranged. Their chief object was, besides providing additional information as to the proportion of the nitrogen of the food which is reclaimed in the manure, to acquire direct experimental evidence on the questions whether or not or in what proportions cellulose or woody fibre, which enters so largely into the composition of the food, especially of oxen and sheep, is digested, and contributes to meet the respiratory requirements of the body, or to the forma-

tion of fat? Or whether, on the other hand, it serves little other purpose than that of supplying bulk, and dilution, so to speak, of the other constituents of the food—thus aiding their digestion and assimilation, and then passing off, itself undigested and unchanged?

It is obviously necessary for the elucidation of the points involved in these questions to determine, as far as chemistry enables us to do so, not only the amount of cellulose consumed in the food, but also the quantity voided in the excrements. Hence, although a large portion of the analyses have already been made, the consideration of them will be reserved until we enter upon the general subject of the composition of the manure. In order, however, to relieve from extraneous matter as far as possible the subsequent report on the composition of the excrements of fattening animals, which will of itself involve the record of a vast amount of detail, it is proposed to give, on the present occasion, the results of the experiments referred to so far only as they relate to the amount of food consumed and of increase yielded.

With a view to the special objects above stated it was necessary to employ foods in which the proportion of woody fibre, and of the other non-nitrogenous constituents, would be pretty constant, and be comparatively easily determined. It was further desirable that, in some cases at least, the animals should have a somewhat excessive proportion of woody fibre in their food; that in others the proportion of the more easily digestible non-nitrogenous substances (starch, fatty matter, &c.), should be more liberal; and that the amount and character of these other non-nitrogenous constituents should vary in the different experiments. It was hence thought undesirable, at any rate in the first experiments on the point, to employ roots or other succulent food, the composition of which would not only be more subject to change during the course of the experiment, but would be more difficult and uncertain of determination in a large bulk, even at any one given time. Various so-called "dry foods" only, and water, were therefore selected; and although, in some cases, these were, as such, of good quality, the result was, as might be expected, that the rate of increase was comparatively small in the absence of a certain proportion of the more natural succulent food.

A number of 3-year-old Hampshire Down wether sheep, in very poor condition, had some time previously been purchased for the purposes of experiment. From these, 20 were selected, and divided into 4 lots of 5 each, in such manner that, as far as possible, each sheep should have its representative in weight and other characters in each of the other pens. They were put up on rafters, under cover, on November 30, 1860.

As the staple of the food throughout the experiments was to be

meadow-hay chaff, all 4 pens were supplied with this food alone, and water (each *ad libitum*), for a preliminary period of 8 weeks, namely, up to January 25, 1861. It was intended that from this date the sheep in one pen should have hay-chaff alone; in a second, hay-chaff, with a certain amount of straw-chaff to increase the proportion of woody fibre; in the third, a limited quantity of ground barley, with hay-chaff *ad libitum;* and in the fourth, besides hay-chaff *ad libitum*, beans containing nitrogen equal to that in the barley of pen 3, and the deficiency of starch in the smaller quantity of beans compared with that in the barley, to be made up by oil, in the proportion of 1 part of oil for 2½ parts of starch, this being (in round numbers) theoretically the relation of the two substances in respiratory and fat-forming capacity.

The object was to supply in one of the dietaries only so much digestible matter beyond the cellulose or woody-fibre as would just keep the animals from losing weight, in fact to provide them with mere sustenance, not fattening food. It was found, however, that even this condition was not maintained when any straw-chaff was mixed with the hay. Accordingly, after a few weeks' trial, any admixture of straw was abandoned; hay-chaff alone was adopted as the standard or mere sustenance food, and the following was the final arrangement of the experiments:—

Pen 1. Meadow-hay-chaff alone, *ad libitum.*

Pen 2. 1 lb. of ground beans per head per day; meadow-hay-chaff *ad libitum.*

Pen 3. 1 lb. of ground barley per head per day; meadow-hay-chaff *ad libitum.*

Pen 4. About 6½ ounces of ground beans, and about 3¼ ounces of linseed oil, per head per day; meadow-hay-chaff *ad libitum.*

All the sheep had, in addition, an unlimited supply of water always within their reach, of which, after the first 4 weeks of the experimental period, the quantity taken was determined.

The above quantities of beans and linseed oil given in Pen 4, were those settled at the commencement by calculation, taking an assumed average composition for barley and beans; but the amounts were after a time slightly varied, when analyses of the foods actually employed were made, and then again when fresh stocks were brought into use, and fresh analyses made accordingly.

The experiments were continued as above described till September 6, 1861, that is, for a period of 40 weeks from the time the sheep were first put up, and of 32 weeks from the time they commenced with the special foods. They were then killed, and the weights of the carcass and other parts determined.

The results are recorded in a series of Tables, as follow—those given in Tables I. and II. relating to both the "Preliminary" and

Table I.—Weights and

	Preliminary Period (1860-61).				Experimental				
	Weights when put up, Nov. 30.	Gain (or Loss) lbs. In 4 Weeks to Dec. 28.	In 4 Weeks to Jan. 25.	Total in 8 Weeks.	Weights, Jan. 25, 1861.	Gain (or In 4 Weeks to Feb. 22.	In 4 Weeks to Mar. 22.	In 4 Weeks to Apr. 19.	In 4 Weeks to May 17.
									Pen 1.—Food :*—
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1	126	− 5	− 8	−13	113	10	1½	½	5¼
2	119	0	3	3	122	− 2	2½	1	8
3	126	5	0	5	131	0	10½	2¾	10
4	112	7	0	7	119	− 8	4½	2½	6¼
5	112	1	2	3	115	− 1	2	5	6
Total ..	595	8	− 3	5	600	− 1	21	11¾	35½
Average	119	1·6	− 0·6	1	120	− 0·2	4·2	2·35	7·1
									Pen 2.—Food :*—Beans in limited
1	119	0	0	0	119	− 6	3	8¼	3
2	122	− 1	2	1	123	− 3	5	5	− 2¼
3	122	− 2	− 1	− 3	119	− 6	6½	3	6½
4	112	− 4	2	− 2	110	− 1	5	7¼	8¾
5	118	− 5	− 1	− 6	112	− 5	6½	5	5
Total ..	593	−12	2	−10	583	−21	26	28½	21
Average	118·6	− 2·4	0·4	− 2	116·6	− 4·2	5·2	5·7	4·2
									Pen 3.—Food :*—Barley in limited
1	112	− 3	− 2	− 5	107	1	2	8½	3
2	119	− 1	− 2	− 3	116	5	9½	7½	5
3	133	1	− 2	− 1	132	6	5	8	2½
4	122	− 1	− 1	− 2	120	1	6	10¼	2¾
5	110	6	− 2	4	114	0	6	8	3½
Total ..	596	2	− 9	− 7	589	13	28½	42¼	16¾
Average	119·2	0·4	− 1·8	− 1·4	117·8	2·6	5·7	8·45	3·35
									Pen 4.—Food :*—Beans and Linseed Oil in
1	119	− 5	2	− 3	116	6	8	8½	4
2	124	− 1	5	4	128	2	3½	6½	0½
3	126	2	1	3	129	2	7	8	− 1¼
4	122	4	4	8	130	3	5	7¼	4¼
5	100	1	− 2	− 1	99	1	7½	3¼	4¼
Total ..	591	1	10	11	602	14	31	33½	11¾
Average	118·2	0·2	2	2·2	120·4	2·8	6·2	6·7	2·35

* The above descriptions of food apply only to the "Experimental Period;" during the "Preliminary Period" 8 weeks after the commencement

Gain, &c., of the Sheep.

Period (1861).									
Loss) lbs.							Final weights, Sept. 6.	Wool (shorn May 17).	Final weights with wool added.
In 4 Weeks to June 14.	In 2 Weeks to June 28.	In 4 Weeks to July 26.	In 4 Weeks to Aug. 23.	In 2 Weeks to Sept. 6.	Total in 32 Weeks.	Average per Head per Week.			
Meadow-hay-chaff alone, *ad libitum.*									
lbs. ozs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.	lbs.	lbs. ozs.	lbs. ozs.
13 8	− 9½	− 4¾	− 6¾	− 3¼	6 8	0 3¼	114	5 8	119 8
1 4	3½	1	1½	− 2½	14 4	0 7	131	5 4	136 4
3 11	− 3¾	− 1	7¼	1	30 7	0 15¼	153¾	7 11	161 7
5 4	0	− 2¼	2½	4	14 12	0 7½	127½	6 4	133 12
3 6	− 3½	2	− 0¼	4¾	18 6	0 9¼	128	5 6	133 6
27 1	−13¼	− 5	4¼	4	84 5	..	654¼	30 1	684 5
5 6·6	− 2·65	− 1	0·85	0·8	16 13·8	0 8½	130·9	6 0·2	136 14
quantity ; Meadow-hay-chaff *ad libitum.*									
4 10	2½	4	− 0½	4	22 14	0 11½	137½	4 6	141 14
7 3	− 2½	5	3½	− 0¼	17 11	0 8¾	136	4 11	140 11
5 14	4¼	2	3½	3	28 10	0 14¼	141	6 10	147 10
9 2	− 0½	− 3½	5	1¼	31 10	0 15¾	137	4 10	141 10
7 0	− 2	2¼	3	1½	23 4	0 11¾	129¾	5 8	135 4
33 13	1¾	10	14½	9½	124 1	..	681¼	25 13	707 1
6 12·2	0·35	2	2·9	1·9	24 13	0 12½	136¼	5 2·6	141 7
quantity ; Meadow-hay-chaff *ad libitum.*									
4 13	− 1	0½	7½	− 2	24 5	0 12¼	125	6 5	131 5
10 0	− 2	2½	3¾	1	42 4	1 5¼	152½	5 12	158 4
7 4	0½	1¾	4½	− 1¼	34 4	1 1¼	160½	5 12	166 4
7 1	− 1¼	1	5¾	0¼	32 13	1 0½	148½	4 5	152 13
8 14	− 9	8	5	0	30 6	0 15¼	138	6 6	144 6
38 0	−12¾	13¾	26½	− 2	164 0	..	724½	28 8	753 0
7 9·6	− 2·55	2·75	5·3	− 0·4	32 12·8	1 0½	144·9	5 11·2	150 10
limited quantity ; Meadow-hay-chaff *ad libitum.*									
9 8	2	7½	6	1¼	52 12	1 10½	163½	5 4	168 12
7 6	0¼	7¼	3½	3½	34 6	1 1¼	156	6 6	162 6
12 0	0¼	− 2	2¼	2½	30 12	0 15½	154	5 12	159 12
7 14	− 3	− 2½	2	− 0½	23 6	0 11¾	147	6 6	153 6
6 13	− 4	2¾	6½	2¼	30 5	0 15¼	123½	5 13	129 5
43 9	− 4½	13	20¼	9	171 9	..	744	29 9	773 9
8 11·4	− 0·9	2·6	4·05	1·8	34 5	1 1¼	148·8	5 14·6	154 11

all the sheep had hay-chaff alone; and in Pen 2 the limited food (beans) was not given until March 22, that is, of the Experimental Period.

TABLE II.—TOTAL AMOUNTS of FOOD consumed in each Pen during each separate Period, and the Total Period of the Experiment.

	Preliminary Period (1860-61).		Experimental Period (1861).									
	4 Weeks to Dec. 28.	4 Weeks to Jan. 25.	4 Weeks to Feb. 22.	4 Weeks to Mar. 22.	4 Weeks to April 19.	4 Weeks to May 17.	4 Weeks to June 14.	2 Weeks to June 28.	4 Weeks to July 26.	4 Weeks to Aug. 23.	2 Weeks to Sept. 6.	Total 32† Weeks.
PEN 1.—5 Sheep.												
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Meadow-hay-chaff ..	443	447	423	412¼	442¾	471¼	508	238¼	469¼	467¾	226¼	3658¾
Water	..	..	..	662¼	806	910¾	791	386¾	769	870	441½	5637¼
PEN 2.—5 Sheep.												
Beans	..	..	..	..	105	140	140	70	140	140	70	805
Meadow-hay-chaff ..	439	450	339*	405¼	379½	362¼	396¾	198¾	373¼	363	152¼	2225¾
Total	..	..	339*	405¼	484½	502¼	536¾	268¾	513¼	503	222¼	3030¾
Water	..	..	..	666	906	938¼	840¾	409½	796	878¾	415¾	5185
PEN 3.—5 Sheep.												
Barley	..	..	140	140	140	140	140	70	140	140	70	1120
Meadow-hay-chaff ..	455	456	325	339½	369	372¼	401½	188¼	382¼	360¼	161	2899
Total	..	..	465	479½	509	512¼	541½	258¼	522¼	500¼	231	4019
Water	..	..	..	642¼	865½	877	799¼	404¼	812¾	871¼	411¼	5683½
PEN 4.—5 Sheep.												
Beans	..	..	57	57	57	55¼	50	25	50	50	25	426¼
Linseed oil	..	..	28½	28½	28½	28½	28	14	28	28	14	226
Meadow-hay-chaff ..	465	460	339	376	372	378¾	399¾	195	378¾	359½	151	2949¾
Total	..	..	424½	461½	457½	462½	477¾	234	456¾	437½	190	3602
Water	..	..	..	798¼	965¾	971¼	803	405	782	862½	399	5986¾

* For 21 days, from Jan. 25 to Feb. 15, this food was 3 parts hay-chaff and 1 part straw-chaff; the total food of the month being made up as follows:—278 lbs. hay-chaff + 61 lbs. straw-chaff = 339 lbs. total.

† In Pen 2 the total amounts of both food and water apply to only 24 weeks (commencing March 22); and in the other Pens the water to only 28 weeks (commencing February 22).

TABLE III.—Average Consumption of Food, per Head, per Week, during each Separate Period, and the Total Period of the Experiment.

	PERIODS.																		Total Period, January 25 to September 6; 32 Weeks.†	
	4 Weeks to February 22.		4 Weeks to March 22.		4 Weeks to April 19.		4 Weeks to May 17.		4 Weeks to June 14.		2 Weeks to June 28.		4 Weeks to July 26.		4 Weeks to August 23.		2 Weeks to September 6.			
PEN 1.																				
	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Meadow-hay-chaff ..	21	3	20	10	22	2	23	9	25	7	23	13	23	8	23	6	22	10	22	14
Water	..		33	2	40	5	45	9	39	9	38	11	38	7	43	8	44	3	40	4
PEN 2.																				
Beans	..		..		5	4	7	0	7	0	7	0	7	0	7	0	7	0	6	11¼
Meadow-hay-chaff ..	16	15*	20	4	19	0	18	2	19	13	19	14	18	11	18	3	15	4	18	9
Total	..		..		24	4	25	2	26	13	26	14	25	11	25	3	22	4	25	4¼
Water	..		33	5	45	5	46	15	42	1	40	15	39	13	43	15	41	9	43	3
PEN 3.																				
Barley	7	0	7	0	7	0	7	0	7	0	7	0	7	0	7	0	7	0	7	0
Meadow-hay-chaff ..	16	4	17	0	18	7	18	10	20	1	18	13	19	2	18	0	16	2	18	2
Total	23	4	24	0	25	7	25	10	27	1	25	13	26	2	25	0	23	2	25	2
Water	..		32	2	43	5	43	14	40	0	40	7	40	10	43	9	41	2	40	10
PEN 4.																				
Beans	2	13½	2	13½	2	13½	2	12¼	2	8	2	8	2	8	2	8	2	8	2	10½
Linseed oil	1	6¾	1	6¾	1	6¾	1	6¾	1	6½	1	6½	1	6½	1	6½	1	6½	1	6½
Meadow-hay-chaff ..	16	15	18	13	18	10	18	15	20	0	19	8	18	15	18	0	15	2	18	7
Total	21	3¼	23	1¼	22	14¼	23	2¼	23	14½	23	6½	22	13½	21	14½	19	0½	22	8
Water	..		39	15	48	5	48	9	40	2	40	8	39	2	43	2	39	15	42	12

* For 21 days, from Jan. 25 to Feb. 15, the food in Pen 2 was 3 parts hay-chaff and 1 part straw-chaff.

† In Pen 2 the average amounts of both food and water are taken only over 21 weeks (commencing March 22); and in the other Pens the water over only 28 weeks (commencing February 22).

TABLE IV.—AVERAGE CONSUMPTION of FOOD, per 100 lbs. Live-weight, per Week, during each Separate Period, and the Total Period of the Experiment.

	Periods.																		Total Period, January 25 to September 6; 32 Weeks.†	
	4 Weeks to February 22.		4 Weeks to March 22.		4 Weeks to April 19.		4 Weeks to May 17.		4 Weeks to June 14.		2 Weeks to June 28.		4 Weeks to July 26.		4 Weeks to August 23.		2 Weeks to September 6.			
Pen 1.																				
	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Meadow-hay-chaff ..	17	10	16	15	17	11	18	2	19	8	18	2	18	3	18	1	17	6	17	13
Water	..		27	3	32	3	35	1	30	6	29	7	29	10	33	9	33	14	31	6
Pen 2.																				
Beans	..		..		4	5¾	5	9¼	5	9	5	6¾	5	5¾	5	4¼	5	2¾	5	3
Meadow-hay-chaff ..	16	5*	17	10	15	12	14	7	15	13	15	6	14	5	13	11	11	4	14	5
Total	..		..		20	1¾	20	0¼	21	6	20	12¾	19	10¾	18	15¼	16	6¾	19	8
Water	..		28	15	37	10	37	7	33	7	31	11	30	8	33	1	30	12	33	6
Pen 3.																				
Barley	5	14	5	11	5	6	5	2	5	2	5	1	5	1	4	15	4	13	5	4
Meadow-hay-chaff ..	13	10	13	13	14	3	13	11	14	12	13	10	13	13	12	10	11	2	13	8
Total	19	8	19	8	19	9	18	13	19	14	18	11	18	14	17	9	15	15	18	12
Water	..		26	1	33	3	32	3	29	6	29	3	29	5	30	9	28	6	30	0
Pen 4.																				
Beans	2	5½	2	4	2	2¼	2	0¼	1	13¼	1	12½	1	12¼	1	11½	1	11	1	15
Linseed Oil	1	2¾	1	2	1	1	1	0½	1	0¼	1	0	0	15¾	0	15½	0	15¼	1	0½
Meadow-hay-chaff ..	13	15	14	14	14	1	13	13	14	10	13	14	13	6	12	7	10	4	13	7
Total	17	7¼	18	4	17	4¼	16	13¾	17	7½	16	10½	16	2	15	2	12	14¼	16	6½
Water	..		31	10	36	6	35	6	29	5	28	12	27	10	29	12	27	0	30	13

* For 21 days, from January 25 to February 15, the food in Pen 2 was 3 parts hay-chaff and 1 part straw-chaff.

† In Pen 2, the average amounts of both food and water are taken only over 24 weeks (commencing March 22); and in the other pens the water over only 28 weeks (commencing February 22).

TABLE V.—Showing the TEMPERATURE of the FEEDING SHED, and the FOOD consumed and WATER drank per 100 lbs. Live-weight, during each Week, from April 12 to August 23.

	PERIODS OF 7 DAYS.																			Average.
	To April 19.	To April 26.	To May 3.	To May 10.	To May 17.	To May 24.	To May 31.	To June 7.	To June 14.	To June 21.	To June 28.	To July 5.	To July 12.	To July 19.	To July 26.	To Aug. 2.	To Aug. 9.	To Aug. 16.	To Aug. 23.	
Temperature—Fahr.																				
Mean Temperature at 6 A.M.	41·1	43·1	42·4	38·6	44·6	51·3	52·9	53·0	51·3	60·3	60·0	61·1	59·1	60·7	61·6	58·6	60·6	64·1	59·2	53·7
,, ,, at 12 M.	49·7	50·6	49·9	46·3	53·9	60·9	60·9	56·6	54·7	67·9	65·3	62·3	63·4	64·3	64·6	66·0	66·7	69·7	65·3	59·9
,, ,, at 5 P.M.	48·3	51·6	49·3	47·0	54·9	63·4	62·7	57·0	55·7	70·3	66·4	65·4	65·6	65·9	65·7	65·3	69·3	70·3	64·3	61·0
Range of Temperature at 6 A.M.	3·0	15·0	13·0	14·0	12·0	19·0	6·0	8·0	3·0	14·0	9·0	13·0	5·0	11·0	6·0	5·0	6·0	7·0	5·0	9·2
,, ,, at 12 M.	10·0	8·0	19·0	8·0	21·0	22·0	14·0	7·0	2·0	9·0	9·0	6·0	4·0	5·0	5·0	10·0	11·0	15·0	7·0	10·1
,, ,, at 5 P.M.	10·0	12·0	15·0	5·0	23·0	22·0	15·0	7·0	5·0	9·0	8·0	9·0	6·0	5·0	4·0	8·0	9·0	15·0	7·0	10·2
PEN 1.—Food: Hay-chaff alone, *ad libitum*.																				
	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
Total Food	18 1	17 12	17 12	18 10	18 7	17 8	18 8	20 14	21 3	18 6	17 14	16 13	18 15	18 9	18 1	18 11	18 0	17 10	17 14	18 6
Water	30 15	32 5	35 15	33 2	38 14	20 11	31 12	32 1	37 2	29 1	29 13	27 4	31 11	28 8	31 3	33 4	34 9	34 15	31 9	31 12
PEN 2.—Food: Beans in limited quantity; Hay-chaff *ad libitum*.																				
Total Food	22 5	19 13	20 10	19 12	19 15	18 10	21 6	22 2	23 4	20 13	20 12	19 0	20 4	20 8	19 0	19 6	19 3	18 0	19 3	20 2
Water	40 12	38 2	38 6	35 2	38 0	25 15	36 3	34 14	36 13	29 14	33 8	30 1	31 6	30 7	30 3	31 14	34 6	35 13	30 4	33 10
PEN 3.—Food: Barley in limited quantity; Hay-chaff *ad libitum*.																				
Total Food	20 7	18 13	18 10	18 2	19 10	18 5	19 9	20 4	21 8	19 2	18 3	18 15	18 15	19 8	18 1	17 4	18 2	17 0	17 13	18 12
Water	35 9	32 2	32 6	31 0	33 5	27 0	31 2	27 8	31 15	30 10	27 12	30 4	30 13	28 4	27 15	30 12	31 11	30 7	29 4	30 6
PEN 4.—Food: Beans and Linseed Oil in limited quantity; Hay-chaff *ad libitum*.																				
Total Food	17 7	16 8	17 1	16 4	17 10	15 10	17 2	17 9	19 7	16 5	17 0	15 3	16 3	16 7	16 12	15 0	15 6	14 13	15 3	16 5
Water	36 12	36 11	33 15	33 3	37 12	26 1	29 7	29 2	32 12	30 5	27 4	25 9	27 15	27 13	29 2	28 4	30 7	30 14	29 7	30 5

TABLE VI.—QUANTITIES of FOOD Consumed during each Separate Period, and the Total Period of the Experiment, to produce 100 lbs. Increase in Live-weight.

	PERIODS.									Total Period, January 25 to September 6; 32 Weeks.†
	4 Weeks to February 22.	4 Weeks to March 22.	4 Weeks to April 19.	4 Weeks to May 17.	4 Weeks to June 14.	2 Weeks to June 28.	4 Weeks to July 26.	4 Weeks to August 23.	2 Weeks to September 6.	
PEN 1.										
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Meadow-hay-chaff ..	*	1964	3767	1328	1877	*	*	11007	5655	4340
Water		3154	6860	2565	2923			20471	11038	6608
PEN 2.										
Beans	*	..	369	664	414	4000	1400	966	737	676
Meadow-hay-chaff ..		1559	1332	1725	1173	11354	3733	2504	1604	1870
Total		..	1701	2389	1587	15354	5133	3470	2341	2546
Water		2561	3180	4468	2486	23393	7961	6061	4375	4355
PEN 3.										
Barley	1077	491	331	836	369	*	1018	528	*	683
Meadow-hay-chaff ..	2500	1191	873	2223	1056		2781	1360		1768
Total	3577	1682	1204	3059	1425		3799	1888		2451
Water	..	2254	2048	5236	2103		5910	3288		3764
PEN 4.										
Beans	407	184	170	470	115	*	385	247	278	249
Linseed oil	204	92	85	242	64		216	138	156	132
Meadow-hay-chaff ..	2422	1213	1110	3222	918		2915	1775	1679	1720
Total	3033	1489	1365	3934	1097		3516	2160	2113	2101
Water	..	2576	2883	8267	1843		6016	4259	4433	3800

* In these cases there was no increase.

† In Pen 2 the average amounts of both food and water are taken only over 24 weeks (commencing March 22); and in the other Pens the water over only 28 weeks (commencing February 22).

TABLE VII.—AVERAGE INCREASE per Head per Week, and per 100 lbs. Live-weight per Week, during each Separate Period, and the Total Period of the Experiment.

Pens.	Description of Food.	PERIODS.																		Total Period, 32 Weeks.*	
		4 Weeks to Feb. 22.		4 Weeks to March 22.		4 Weeks to April 19.		4 Weeks to May 17.		4 Weeks to June 14.		2 Weeks to June 28.		4 Weeks to July 26.		4 Weeks to August 23.		2 Weeks to Sept. 6.			
	Per Head per Week.																				
		lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
1	Hay-chaff	−0	1	1	1	0	10	1	13	1	6	−1	5	−0	4	0	4	0	7	0	8½
2	Beans and hay-chaff					1	7	1	1	1	11	0	3	0	8	0	12	0	15	1	0
3	Barley and hay-chaff	0	11	1	7	2	2	0	14	1	15	−1	5	0	11	1	5	−0	3	1	0½
4	Beans, linseed oil, and hay-chaff ..	0	11	1	9	1	11	0	10	2	3	−0	7	0	11	1	0	0	15	1	1¼
	Per 100 lbs. Live-weight per Week.																				
1	Hay-chaff	−0	1	0	14	0	8	1	6	1	1	−1	0	−0	3	0	3	0	5	0	6½
2	Beans and hay-chaff					1	3	0	14	1	6	0	2	0	6	0	9	0	11	0	12¼
3	Barley and hay-chaff	0	9	1	3	1	10	0	10	1	6	−0	15	0	8	0	15	−0	2	0	12¼
4	Beans, linseed oil, and hay-chaff ..	0	9	1	4	1	4	0	7	1	10	−0	5	0	7	0	11	0	10	0	12½

* In the case of Pen 2, the averages apply to only 24 weeks (commencing March 22).

TABLE VIII.—LIVE and DEAD WEIGHTS, &c. Fasted 24 to 30 hours. Killed, September 9, 1861.

	ALIVE.					DEAD.					
				FINAL WEIGHTS.		ACTUAL WEIGHTS.			PER CENT.		
	Original Weights, January 25.	Increase in 32 Weeks.	Wool Shorn, May 17.	Unfasted, September 6.	Fasted, September 9.	Carcass as soon as Dressed.	Carcass 25 to 32 hours after Killing.*	Loose Fat.	Cold Carcass in Unfasted Weight.	Cold Carcass in Fasted Weight.	Loose Inside Fat in Fasted Weight.
PEN 1.—Food: Hay-chaff alone, *ad libitum.*											
	lbs.	lbs. ozs.	lbs. ozs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.	lbs. ozs.			
1	113	6 8	5 8	114	109¾	49 11	47 5	3 1	41·5	43·1	2·79
2	122	14 4	5 4	131	130¼	63 13	61 9	5 6	47·0	47·3	4·12
3	131	30 7	7 11	153¼	142¾	68 0	65 6	7 0	42·5	45·8	4·92
4	119	14 12	6 4	127½	118¾	58 0	55 11	4 5	43·7	46·9	3·65
5	115	18 6	5 6	128	119¼	58 0	55 12	4 6	43·6	46·6	3·67
Average	120	16 14	6 0	131	124¼	59 8	57 2	4 13	43·7	45·9	3·83
PEN 2.—Food: Beans in limited quantity; Hay-chaff *ad libitum.*											
1	119	22 14	4 6	137½	128	63 8	61 3	9 1	44·5	47·8	7·08
2	123	17 11	4 11	136	130	71 4	69 1	7 5	50·8	53·1	5·64
3	119	28 10	6 10	141	134½	73 14	71 12	9 4	50·9	53·3	6·85
4	110	31 10	4 10	137	129¼	67 8	65 0	5 11	47·4	50·3	4·39
5	112	23 4	5 8	129¾	123¼	65 0	62 12	5 1	48·4	50·7	4·08
Average	116·6	24 13	5 3	136¼	129	68 4	65 15	7 4	48·6	51·0	5·61
PEN 3.—Food: Barley in limited quantity; Hay-chaff *ad libitum.*											
1	107	24 5	6 5	125	119¼	61 7	59 2	4 0	47·3	49·6	3·37
2	116	42 4	5 12	152½	142¼	75 0	72 10	12 6	47·6	50·9	8·68
3	132	34 4	5 12	160½	155	85 8	83 2	9 7	51·8	53·6	6·09
4	120	32 13	4 5	148½	139	72 11	70 10	9 13	47·6	50·8	7·07
5	114	30 6	6 6	138	130¾	75 6	73 4	8 15	53·0	56·0	6·86
Average	117·8	32 13	5 11	145	137¼	74 0	71 12	8 15	49·5	52·2	6·41
PEN 4.—Food: Beans and Linseed Oil in limited quantity; Hay-chaff *ad libitum.*											
1	116	52 12	5 4	163½	154½	84 12	82 12	15 14	50·6	53·6	10·28
2	128	34 6	6 6	156	145	83 0	81 0	11 10	51·9	55·9	8·02
3	129	30 12	5 12	154	146¼	84 0	82 1	14 10	53·3	55·9	9·95
4	130	23 6	6 6	147	141¼	80 15	78 11	8 9	53·5	55·7	6·06
5	99	30 5	5 13	123½	115¼	64 3	62 5	10 13	50·5	53·8	9·34
Average	120·4	34 5	5 15	148¾	140¼	79 6	77 6	12 5	52·0	55·0	8·73

* The beans were given for only 24 weeks (commencing March 22).

TABLE IX.—SUMMARY of Tables I., II., III., IV., VI., VII., and VIII.

	Food Consumed. Total.	Food Consumed. Average per Head, per Week.	Food Consumed. Average per 100 lbs. Live-weight per Week.	Food Consumed. To produce 100 lbs. Increase in Live-weight.	Increase. Total.	Increase. Average per Head, per Week.	Increase. Average per 100 lbs. Live-weight per Week.	Dead-weights. Carcass. Average per Head.	Dead-weights. Carcass. Average per Cent. in Fasted-weight	Dead-weights. Average Loose Inside Fat per Head.
Pen 1 (5 Sheep, 32 Weeks).										
	lbs.	lbs. ozs.	lbs. ozs.	lbs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.		lbs. ozs.
Meadow-hay-chaff ..	3658¾	22 14	17 13	4340	84 5	0 8½	0 6½	57 2	45·9	4 13
Water	..	40 4	31 6	6608						
Pen 2 (5 Sheep, 24 Weeks).										
Beans	805	6 11¼	5 3	676	119 1	1 0	0 12¼	65 15	51·0	7 4
Meadow-hay-chaff ..	2225¾	18 9	14 5	1870						
Total	3030¾	25 4¼	19 8	2546						
Water	..	43 4	33 6	4355						
Pen 3 (5 Sheep, 32 Weeks).										
Barley	1120	7 0	5 4	683	164 0	1 0½	0 12¼	71 12	52·2	8 15
Meadow-hay-chaff ..	2899	18 2	13 8	1768						
Total	4019	25 2	18 12	2451						
Water	..	40 10	30 0	3764						
Pen 4 (5 Sheep, 32 Weeks).										
Beans	426¼	2 10½	1 15	249	171 9	1 1¼	0 12½	77 6	55·0	12 5
Linseed oil	226	1 6½	1 0½	132						
Meadow-hay-chaff ..	2949¾	18 7	13 7	1720						
Total	3602	22 8	16 6½	2101						
Water	..	42 12	30 13	3800						

and the "Experimental" periods, and those in Tables III. to IX. inclusive, to the "Experimental" period only:—

Table I. The weights of each sheep, its gain (or loss) between each weighing, and its total gain.

Table II. The quantities of food consumed (and water drank) in each pen, between each period of weighing, and during the total experimental period.

Table III. The average amount of food consumed (and water drank) *per head per week*, between each weighing, and over the total experimental period.

Table IV. The average amount of food consumed (and water drank) *per* 100 *lbs. live weight per week*, between each weighing, and over the total experimental period.

Table V. The average amount of food consumed (and water drank) *per* 100 *lbs. live weight per week*, during each of 19 consecutive weeks, with the mean temperature and range of temperature of the feeding-house, at different times of the day for each of those weeks.

Table VI. The amounts of food consumed (and water drank) *to produce* 100 *lbs. increase in live-weight*, between each weighing, and over the total experimental period.

Table VII. The average amount of increase *per head per week*, and *per* 100 *lbs. live weight per week*, between each weighing, and over the total experimental period.

Table VIII. The original and final weights, the total increase, the wool, and the weights and proportions in the fasted weight of the carcasses, and of the inside loose fat.

Table IX. is a summary of Tables I., II., III., IV., VI., VII., and VIII.

The Summary Table (IX.) shows at one view the average results over the whole experimental period on each of the points to which the other tables respectively relate; and it is to it that we would refer the reader for a record of the main facts of the experiments; though, in the few remarks we shall have to make upon them, we shall necessarily be guided by a careful consideration of the detail as given in the other tables.

The general result of the experiments is, as might be expected, that sheep thus fed upon dry food alone (with water) increased very little compared with the average result obtained with a good mixed diet of dry and succulent food.

Table I., giving the detail of the weights and gain or loss of each sheep, shows that most of them lost weight more or less at one time or another during the progress of the experiment. Those in Pen 1, on hay-chaff alone, lost the most frequently, and finally gave the least total increase; but as the object in their case was to put their capability of digesting cellulose or woody-

fibre to the test, a better rate of increase would have been objectionable, as it might have indicated that they had too much of the more easily digested non-nitrogenous compounds in their food. On each of the four dietaries there is a general disposition to show a loss of weight during the latter half of June; but during the previous few weeks, immediately succeeding the shearing, there had been a more than usual increase in gross weight, after which hot weather set in somewhat suddenly.

The final result was, as shown in detail in Table VII., and in summary in the 6th and 7th columns of Table IX., that, over a period of half a year or more, the sheep upon hay-chaff alone gave an average increase in live-weight of little more than ½ lb., and those upon beans and hay, barley and hay, and beans linseed-oil and hay, only about 1 lb. per head per week. Calculated upon each 100 lbs. live-weight instead of per head, the increase per week was only 6½ ozs. upon hay-chaff alone, and only a fraction over 12 ozs. upon each of the other descriptions of food, notwithstanding that these comprised, besides hay-chaff *ad libitum*, in Pen 2, 1 lb. of beans, in Pen 3, 1 lb. of barley, and in Pen 4, beans and linseed oil equivalent to 1 lb. of barley, per head per day.

It should be remarked with regard to the above rates of increase upon 100 lbs. live-weight per week, that the amount with the hay-chaff alone is somewhat less than one-fourth, and that in each of the other pens, with corn, &c., in addition, is somewhat less than one-half of that which should be yielded by sheep fed liberally, under cover, and having a fair proportion of succulent food. It is reckoned that, over a fattening period of some months, sheep so fed should give from 1½ to 1¾ lbs. of increase per 100 lbs. live-weight per week.

Nor are the results any more satisfactory when considered in connexion with the amounts of food consumed by a given weight of animal within a given time, or required to produce a given amount of increase.

The third column of the Summary Table (IX.) shows that the amount of food consumed per 100 lbs. live-weight per week was 17 lbs. 13 ozs. of hay alone, 19½ lbs. of hay and beans, 18¾ lbs. of hay and barley, and 16 lbs. 6 ozs. of hay, beans, and linseed oil. It is worthy of remark that the above amount of hay alone would contain almost exactly the quantity of dry substance that is reckoned to be consumed, on the average, when sheep are fed on a good mixed diet of dry and succulent food; that of the hay and beans about 1½ lb., and that of the hay and barley about ¾ lb. in excess of such amount; and that of the hay, beans, and linseed oil—multiplying the oil 2½ times, and reckoning it as starch—would contain very nearly the same amount of dry substance as

the hay and barley. It would appear, therefore, that the amount of indigestible matter contained in the food, practically set a limit to the quantity taken into the stomachs of the animals.

Consistently with the last supposition, the results given in the 4th column of the Summary Table (IX.) show that, in the case of the hay-chaff alone, when the sheep had eaten as much as they were able, there was but little digestible material left available for increase after that which was necessary for respiration and the other current functions of the body had been supplied. Thus, it required 4339½ lbs. of hay-chaff to produce 100 lbs. increase in live-weight—an amount which would contain rather more than four times as much dry substance as is necessary to produce the same amount of increase with a good mixed diet of succulent and dry food. In the three other experiments, in all of which there was a much larger proportion of digestible and assimilable matter, there was only about half as much dry substance of food required to produce the same amount of increase. But, even in their case, the amount was more than twice as much as is required with a good mixture containing a due proportion of succulent food.

The facts just stated show how important it is, in point of economy, to supply fattening animals with food from which they can store up a large amount of increase within a given time. For, the great expenditure of the constituents of the food is in keeping up the respiration and other current functions of life; and this, so to speak, unproductive expenditure will bear a much larger proportion to a given amount of saleable increase when the latter is but tardily stored up.

Although, as has been stated, the amount of food required to produce a given amount of increase was very large, even where the sheep had beans, or barley, or beans and linseed-oil, in addition to the hay, a comparison of the results of the three experiments is of some interest. The 1 lb. of beans per head per day, in Pen 2, supplied considerably more nitrogenous substance than the 1 lb. of barley in Pen 3; yet it required almost identically the same amount of beans as of barley—and with the former about 100 lbs. more of hay-chaff—to yield 100 lbs. increase in live-weight; and the live-weight of the sheep fed on the barley yielded a higher proportion of carcass, and also of loose inside fat. In fact, the mixture of barley and hay was more fattening than that of beans and hay.

It is quite consistent with the results of numerous former feeding experiments, that, provided the supply of nitrogenous constituents have reached a sufficient amount, the increase of the fattening animal should, beyond that point, be more dependent upon the supply of digestible and assimilable *non*-nitrogenous

compounds than upon an increased amount of the nitrogenous ones.

The comparison between the results of Pen 3 and Pen 4—the former with barley, and the latter with a theoretically equivalent mixture of beans and linseed-oil—is of especial interest.

If we suppose the amount of beans and oil actually adopted in Pen 4 to have represented exactly, in *theoretical* equivalent, the barley of Pen 3, so far as the mere *supply* of flesh-forming and respirable and fat-forming material is concerned, the result would show, in practice, a marked superiority where a certain portion of starch was substituted by its calculated equivalent of oil—that is, 2½ parts of starch by 1 part of oil. Thus, the amount of barley required was somewhat more than theoretically equivalent to the amount of beans and oil consumed to produce 100 lbs. increase in live-weight; and there were, besides, about 50 lbs. more hay consumed with the barley than with the beans and oil to yield that amount of increase. Again, the average proportion of carcass in the fasted live-weight was nearly 3 per cent. greater, and the average amount of inside loose fat nearly 1½ time greater, in the sheep fed upon hay, beans, and oil, than in those fed upon hay and barley.

So far as can be judged, the amounts of beans and oil actually consumed per 100 lbs. live-weight in Pen 4 were perhaps slightly more than equivalent, even theoretically, to the barley taken in Pen 3; but certainly by no means sufficiently so to account for the marked difference in the result. There are, indeed, sufficient reasons for concluding that, independently of mere *supply* of constituents, the conditions of their concentration and digestibility, and consequently of their assimilability, must have an influence in determining the relative values for the various requirements of the body, of substances which, in a general, or more purely chemical sense, may still be justly looked upon as mutually replaceable; and although starch and oil are undoubtedly, within certain limits, mutually replaceable in about the proportions above stated, it seems but reasonable to suppose that the tax upon the system will be less in the appropriation of ready-formed fat than of starch from which it may be formed—at any rate for fat-storing, if not for respiration also. The results of these two experiments, so far as they go, afford evidence in favour of the view that such is in reality the case. That in human dietaries there is an advantage in having a portion of the non-nitrogenous matter supplied in the form of fat (as in animal food), instead of nearly the whole of it as starch and allied substances (as in bread, sugar, &c.), cannot be doubted. In fact, one great object attained in fattening animals for the food of man seems to be to get crude non-nitrogenous vegetable products ready formed into fat for his use.

Before passing from a consideration of the results given in the Summary Table, it may be interesting to remark that the proportion of water drank to the food consumed was the greatest in Pen 2, with the hay and beans—that is to say, where the amount of nitrogenous substance consumed was the greatest. This is quite consistent with the observations of ourselves and others, that, under otherwise equal circumstances, the larger the amount of the nitrogenous constituents in the food, the greater will be the amount of urea passed off in the urine, and that, as has recently been shown, the greater the elimination of urea, the greater will be the demand of the system for water. Again, there was a larger proportion of water drank to actual food consumed in Pen 4, with the beans, oil, and hay, than in Pen 3, with barley and hay; but it is worthy of remark, that when the amount of oil is multiplied by 2·5, and so reckoned as starch, and the total amount of food assumed to be in that degree greater in Pen 4, the proportion of water drank to food consumed, as so estimated, is very nearly the same in the two cases.

Whilst referring to the subject of the amount of water drank, attention may be directed to the connexion between the food and water taken, and the temperature and its changes, as indicated by the records given in Table V., which relate to weekly periods, commencing April 13, and ending August 23.

The result indicated is, that there was in every pen a general tendency to an increased consumption of food in proportion to a given weight of the animal towards the middle of the period, and then towards the conclusion a diminution, which was the more marked the better the food and the greater the progress of the animals. On the other hand, there was a diminution in the proportion of water taken towards the middle, and then a slight increase towards the end of the period. It is clear, therefore, that the amount of water taken had not an undeviating relation to the amount of food.

Nor had either the amount of food, or the amount of water, so direct a connexion as might have been anticipated with mere height of temperature, so far as this can be judged of by the readings of a non-registering thermometer at the fixed hours specified. They appear to have been far more influenced by changes, as indicated by the range of temperature at the respective hours during each weekly period, than by the condition of atmosphere as marked by the average actual temperature of the periods.

The very small quantity of water taken in every pen during the week from May 17-24, is not to be attributed to conditions of atmosphere alone, for, although the range of temperature at the specified hours of the day (6 A.M., 12 M., and 5 P.M.) was

unusually great during that period, it is to be borne in mind that it was on May 17 that the sheep lost their wool, which had become very oppressive, and hence probably the large amount of water taken for some time previously, and then the sudden and very great decline. There was also a notable decline in the amount of food consumed in each of the four pens during the week immediately succeeding the shearing.

Finally in regard to the connexion between temperature and the amount of food consumed, it should be observed that the records given in Table V. only relate to the spring and summer, and to the actual temperature at three selected hours of the day, so that they do not by any means so satisfactorily illustrate the influence of the conditions of atmosphere upon the consumption of food as they would, had they included the preceding winter, and also the registry of the maximum and minimum temperatures, and the conditions of moisture. Nor, on the other hand, is the whole of the decline of consumption towards the end of the period to be set down to the increased temperature as the season advanced. There is, as a rule, a diminution in the amount of food eaten in proportion to the weight of the body as animals fatten, so that a portion of the diminution indicated in the Table must be attributed to the progressive condition of the animals as to maturity. Consistently with this, the diminution is the least where the sheep had hay alone and scarcely increased at all, and it is the greatest where the tendency to fatten was also the greatest.

In concluding this short supplementary report of experiments on Sheep-feeding, it may be well to state, in a few words, the scope and main bearings of the series of Papers to which it belongs, illustrative of the relations of the food consumed to the weight of the animal, and to the increase in live-weight produced, under different circumstances.

In the first article on the subject, published in this Journal now nearly thirteen years ago (vol. x. part i.), the chief object was to show the comparative feeding values of different descriptions of food; and one important result arrived at was, that when foods contain a certain proportion of nitrogenous substance, which is generally reached in the ordinarily adopted food mixtures, the amounts required, both by a given weight of animal within a given time, and to produce a given amount of increase in live-weight, were then more dependent on the amount of the digestible and assimilable *non*-nitrogenous constituents than on an increased proportion of the nitrogenous ones.

In the next series (vol. xii. part ii., vol. xiii. part i., and vol. xvi. part i.) it was sought to show the comparative adapta-

bility of the most important improved breeds of sheep to the modern system of early and rapid fattening, by means of liberal feeding, combined with shelter from inclement weather. The experiments on this subject being made with large numbers of animals also provided reliable data for determining the average amounts of food, and of its most important constituents, required by a given weight of the animal within a given time, and to produce a given amount of increase in live-weight, under the system of rapid fattening and early maturity.

In the last volume of this Journal (vol. xxii. part i.), it was shown how great is the expenditure of food to produce a given amount of saleable increase when the animals are fed beyond a comparatively moderate degree of fatness.

The results now given show, on the other hand, that there may also be a wasteful expenditure of constituents (by the respiration and other current functions of the body) in proportion to the amount of saleable increase obtained, when the food does not contain a sufficient proportion of easily digestible and assimilable constituents, or when those constituents are not in part supplied to the animal in the succulent condition of its natural food.

It remains to show from the results of the experiments now under consideration, whether or not cellulose or woody-fibre, which enters so largely into the composition of many of our current food-stuffs, is digestible and available for the purposes of the animal economy? and if it be so, in what proportions, and whether in greater or less degree according to the character of the constituents associated with it? But, as already intimated, as the settlement of these questions requires the determination of the cellulose not only in the food consumed but in the excrements voided, the consideration of the results relating to them—though illustrative of the feeding rather than the manure value of the foods—is reserved until we enter into the general question of the relation of the composition of the excrements of animals to that of the food they consume.

Rothamsted, January, 1862.

X.—*On the best mode of getting in the Harvest in a bad Season.* An Essay which received the Prize offered by the Leeds Local Committee in 1861. By Edwin Eddison.

There are few subjects more important to the farmer than the proper harvesting of his corn. My earliest experience of a wet harvest was in the year 1816, when the blackened straw of the barley, which looked like smoked stubble in the month of March, made a lasting and painful impression on my recollection.

The observations which I then made as a boy have been serviceable to me in practice on a farm in Yorkshire of 500 acres. During the last twelve years I have experienced three harvests in which I had not a drop of rain, except what might, unknown to me, have fallen in the night; but I have also had to contend, like the rest of my brethren, with wet weather in the other seasons.

Any suggestions that I make are given, not from theory, but practice and my own observation. My directions will be reduced to the following heads, on each of which I propose to comment very briefly, with this preface only—that I am not aware that I ever had a stack on fire, or was compelled to pull one to pieces. I do not pretend to teach as one who knows more than others, because I feel sure that thousands of farmers could teach me more than I know; but we all know and regret that the knowledge of the most experienced is very apt to live and die with them. My object, then, is to prompt others to set me right where I am wrong, and to give to all the benefit of what little I know myself.

Directions:—

1. Reap early.
2. Make small sheaves.
3. Use single bands.
4. Leave the sheaves open as long as you can before binding.
5. Never allow the sheaves to lie all night on the ground.
6. Make small stooks.
7. Do not use hoods.
8. Rather let corn be "muck in the stook than muck in the stack."
9. Carefully watch it.
10. When dry, quickly cart it.

1. *As to Time of Reaping.*—Corn ripens first in the ear, and next in the straw, whether it be wheat, barley, rye, or oats. I never yet met with any one who could give me a positive rule to know when to cut corn, and I doubt whether there is any such rule. It has been my practice to take six ears of the corn picked from different places, and cut them off a foot long, including the ear, and strike them smartly on the palm of the hand, when, if the grains fall off, the corn is ripe enough to be cut.

Much has been said about cutting early, and I decidedly think it is better to cut too soon than too late. To men in the south this early cutting may not be so important, but my harvest rarely begins until September. On the 28th September, 1856,

I had neither housed nor stacked one sheaf of barley, and very little of wheat or oats. In the South of England they often begin in July. Contrast the length of day and power of the sun, and it needs no argument to show how important it is for us to be as early as we can. On Lammas-day (the 1st of August) the sun rises about 4h. 25m. in the morning, and sets about 7h. 45m. at night. On Michaelmas-day (29th of September), which is often the middle of my harvest, the sun rises about six, and sets about six; the days are rapidly shortening, the dews stronger, the nights longer, and the sun has less power to overcome the dampness: so that, however fine the weather, we rarely can begin to house or stack the corn until half-past ten or eleven o'clock in the morning, and must usually leave work at six or seven at night. Contrast this with Lammas-day, when, the sun being in full power and heavy dews exceptional, you can often cart from six or seven in the morning to eight or nine at night, or about double the time. So much for the benefit of cutting early. But again we come to the question *how* early, and I fear nothing but local experience can answer this question.

With wheat and oats, if the straw be ripe and of a good healthy "straw yellow" colour two or three inches from the top, and if the ear of the oat feel hard to the hand, and the ear of the wheat feel prickly on being squeezed, they are ready to cut. The grains should not yield a milky fluid, but feel firm on pressure between the finger and thumb, and the straw should yield no juice on being twisted or crushed. These signs will be sufficient if the crop be ripening kindly; under other circumstances, when you find the straw ripe at the ground reap immediately, the crop will not improve by standing.

Barley should be of a uniform straw or yellow colour in the grain and awns, and the ear should be bent downwards nearly double. I have had barley out seven weeks, the straw of which was freely eaten by the cattle in the yards in winter; and though there was much clover in it, and the stooks were several times moved from one site to another to dry the butt-ends, nevertheless the sample was not so bad in colour as I have sometimes seen in barley that has been out only half the time; but I was particular in having it dry *at last*. It is very bad management, after all your patience, to house or stack the corn when at all damp. Never do that; its long weatherbeaten endurance fairly entitles it to a dry lair at last.

2. *As to Small Sheaves.*—A sheaf of 9 inches' diameter has the following advantages. It gets dry rapidly, whether by wind or sun, often in less than half the time required by one that is a foot or 15 inches in diameter. It is more easily "set up" when the harvester, at the close of his day, is almost worn-out with

fatigue; and if he have miscalculated his time, and darkness threatens him, a light sheaf, easily lifted and carried by his wife or child, gets properly placed; if its circumference were something like 3 or 4 feet, as we sometimes find in Lincolnshire and Nottinghamshire, it might be left on the ground all night, or carelessly set up, to be blown down by the breeze before morning. Again, with small sheaves such as I have named, you have the further advantage that, if you are short of "hands," either from the Irish labourer having returned home or from the amateur harvester having finished his holiday, with these small sheaves a woman, or even a boy of fourteen years old, will take the fork, and "pitch" 400 of them—about a cart-load—in ten minutes without difficulty.

3. *As to using Single Bands or Bindings.*—By a single band I mean only one length of straw, instead of the ordinary band of two lengths. After twelve years' experience I am satisfied that this is the best plan; it almost dispenses with the band-maker, and there is not so much danger of sprouting at the band as when there are two knots instead of one, especially if the single knot be properly tied and put inside the stook instead of outside; and by having one length only, you are always certain that the sheaf shall not be too large. There is also in threshing an advantage in having single bands: you have one knot to untie instead of two; you save time, and often save the threshing-machine from being strained in bolting these knots.

4. *Leave the Sheaves open.*—By this I mean that when the band is laid on the ground, and so much of the corn placed thereon as will make a sheaf, it should be left untied, so as to get more sun and wind in the middle of the day. When once the sheaf is thoroughly dry, the corn is not so likely to sprout as it would be if the sheaf were bound when freshly-cut. The power of the sun in the middle of the day, from nine to three, playing on the loose straw, will often save two days in making it ready for carting.

5. *Never allow the Sheaves to lie on the Ground all Night.*—Men, in their eagerness to make long days, will sometimes play the trick of leaving nearly a day's work of sheaves on the ground. Even in the dryest time this should not be allowed; but if a pelting rain should come in the night, a sheaf thus left is often so thoroughly saturated with wet that it will take two or three days more to dry than sheaves that have been standing. Besides, the ears of corn being always nearest the ground, they, and the best part of the stems of straw, are often bespattered with dirt and sand, the corn is very dusty in the threshing, and the straw is unpalatable for the cattle.

6. *Make small Stooks.*—Some persons put 12 sheaves in a

stook, others 10, others 8; I prefer 10 because I find in practice they stand up against the wind better than 8, and quite as well as 12. I am aware of the plan adopted in many places of putting 4 sheaves together only. Though in theory I like the 4-sheaf stook, in practice they do not seem to answer as well as 10, but are constantly blown down. This may arise from the labourer's want of practice, for I am told that in Scotland, Wales, and other places, they stand well.

7. *Never use Hoods or Caps.*—The hoods or caps are made by turning the butt-end upwards, spreading out the ears, and making a sort of "fantail," which acts as a roof. There is a great difference of opinion on this point, and I will not speak positively about it. My experience is against the hoods. In the same field I have tried both ways; and the un-hooded stooks having shown the least sprouting, it struck me that as the straw in the hoods is inverted, the rain may not run off them so easily as when it trickles down the straw in its natural position for growth; this may possibly cause more of the wet to lodge in the straw, and thus saturate the ears that are covered so as to make them sprout more than if they were exposed.

8. *It is "better to have muck in the Stook than muck in the Stack."*—All agree in this adage, but the weariness and anxiety of a wet harvest, with the gloomy clouds or the murky atmosphere of October and November, often drive the farmer to improper haste. Yet the greater the age and experience of the farmer, the more you will find that he has come to the conclusion, that there always *has been a time* and therefore he hopes there always will be one for gathering in the crop; and whilst the young man in anxiety and haste rushes too soon to his carting in the *hope* that all will be right, the older and wiser says he *fears* it is not dry and waits patiently, as bygone years of wet harvests have taught him to do. Never in any case house or stack your corn until you can say without a shadow of doubt *it is dry* and ready. To learn whether it is ready put your hand to the middle of the sheaf, and if it be cold or damp it is not ready; if it feel dry and comfortable it is ready. When it is ready and the day fine, as soon as the dew is off, throw or *rather pull* down, very gently, every stook, and let the butt end be put to windward. If it happen that you can expose it to both sun and wind so much the better, unless the wind should happen to be as furious as that which in September, 1860, in a few hours damaged my corn to the extent of at least 240*l.*; in such a case put the *ears* to the wind. I name this because a wet harvest is sometimes a windy harvest. In 1860 every stook in a field of 10 acres was blown down; at least three-fourths of the sheaves were carried across the field, and 5 cart-loads were actually blown over a 4 feet

6 inch wall; many sheaves being found among the trees of a half-grown plantation. Being on the spot and seeing the havoc made in the corn, I at once tried the experiment whether the sheaf would do best with the bottom or the top put to windward. When the butt-end met the wind the sheaf was instantly blown away at the rate of 3 to 5 miles an hour, whilst the top end or ears seemed to present a sort of inclined plane to the wind and to get more firmly fixed the longer it stayed.

9. *Carefully watch the Corn.*—It is often said that a farmer should see every field at least once a day, but in a wet harvest he should see every cornfield at least three times a day. To those who have not done this vigilantly, it is almost incredible how quickly in the months of October and November two or three hours of a drying wind will put thoroughly ripe corn into a fit state for leading; but whilst watching the corn, do not forget to consult the barometer and the weather tables,—not that these are always to be implicitly trusted, but still a great deal is to be learned from both, as well as from the shepherd, the swallow, and the use of your own eyes and ears.

As a wet harvest is always a late one prepare your staddles (or stathels or brandreths, brandreys, or by whatever name the place for the stack is called) in the field, if the homestead be above half a mile from it. Most people think a brandreth the best plan at all times, and it seems reasonable that it should be so; but I have tried the following plan against a really good brandreth, and I confess that whether as regards dryness or freedom from vermin, I could not say that the brandreth deserved any preference. Let the ground of course be perfectly dry; cut a grip 9 or 10 inches deep all around the stack bottom, about a foot from it, and take care that at the lowest point you have a clear opening or watercourse, and throw the cuttings into the middle so as to make the bottom convex. Then put a layer of straw, as much as would be a very good bedding for a tired horse; upon that build your stack, and if you have not tried it, you will be surprised to see how little you lose from damp or vermin. I name this as an easy method of being ready for action. I should rather build on the bare ground so prepared even without straw, than wait a quarter of an hour, if my corn were ready in a wet season. As an expedient, I have sometimes used layers of straw in the stack, but I do not think much of it; I have also sometimes, with good effect, placed hurdles in the middle of the stack to create thorough ventilation; but neither then have I here found much advantage, because though more wind gets in in one place, there is undue pressure in another.

I have also tried drying corn in a room into which hot air was forced by a blowing machine; and on a small scale I have tried

the drying of the ears cut off close to the straw; but I have no present intention of repeating the experiment, the cost being too great. The longer I live, the more confidence I feel in the assurance of Providence that "seed time and harvest" shall not cease, which surely should teach us patience and confidence.

10. *As to Carting or carrying the Corn home as soon as it is ready.*—I always use one-horse carts, with hecks and shelvings, carrying from 13 to 18 cwt. of corn in the straw; I use no cart ropes to tie on with, and rarely lose a sheaf off the carts. Taking into consideration the tying and untying, occasional loss and breakage of ropes, &c., I consider that this alone saves nearly 5 minutes in every load. This is an important saving in unsettled weather, especially when days are shortened. I have often found the "picker" (or pitcher) throw up 400 sheaves in 7½ minutes, sometimes in 5 minutes.

I have here given *my own* experience, but I have also read, where I could, that of other people. Some recommend that the stooks should be made of 8 sheaves only, that is, 4 of the largest, two against two; the two smallest at the ends, so that they prop the stook; and the two longest as "hooders" or "caps" opened well and drawn close to each other over the other six, their butt-ends being of course uppermost. These stooks, they say, rarely blow down. The caps should be tied together by twisting a piece, say half a handful, of the butt-ends of the sheaves on both sides. This, it is said, will sometimes, if well done, resist rain for a month.

In Cornwall they have, or had a practice of making what they call an "arrish-mow." As soon as the wheat is bound, if the weather is doubtful, they make a circular shock of 15 or 20 sheaves standing upright, against this lay a sheaf with the butt-end nearly flat on the ground, the ears bending upwards against the shock. Go round this and make a circle; then begin another row outside in the same manner, keeping the knee on the last sheaves till you have got two or three hundred. Take care to give the ears an increased elevation, so that the whole when finished shall have the appearance of a spire being taper from bottom to top, and from 10 to 15 feet high. The upper part is contracted by increasing the uprightness of the sheaves, and the whole is covered with a sheaf of reed called a cap, which is held on by a straw rope, and seems to resist even long continued rain.

I think the "reed" might in Yorkshire, and in most parts of the North of England, and in all Scotland, find a substitute in fern, or ling, or heather, and the newly invented thatching-machine might perhaps here be brought to our aid.

Those who wish to read more on the subject may refer to—

Sinclair's 'Code of Agriculture,' under the head of Harvest.
'British Husbandry,' vol. ii. p. 106.
Stephens's 'Book of the Farm,' Harvest, &c.
'Communications to the Board of Agriculture,' vol. iv. p. 166.
Johnson's 'Farmer's Almanac,' vol. i., &c.
Morton's 'Farmer's Almanac,' vol. i., &c.
Loudon's 'Encyclopædia of Agriculture,' Wheat, Harvesting, &c.
Young's 'Annals of Agriculture,' Index, Harvest.
'Royal Agricultural Society's Journal,' vol. i., pp. 15, 447; vol. vi., p. 13; ol. viii., p. 75; vol. ix., p. 501; vol. xiii. p. 233; vol. xiv. p. 305.

Leeds, 1*st June*, 1861.

XI.—*On Harvesting Corn.* By PETER LOVE.

PRIZE ESSAY.

THIS being one of the most important works on the farm, has received much attention in every land and every climate; the variation of climate having had more to do in deciding the course pursued than any other consideration. If we commence our survey with the northern and western parts of the United Kingdom, where the greatest difficulties have to be encountered in consequence of the wet and changeable seasons there prevalent, we find the wary Scotchman and the impetuous Irish under the same atmospheric influences adopting the same modes of saving their corn.

In the rainy districts of the West of Scotland the plan of "rickling," or hand field-stacking, obtains, partly in consequence of the prevailing custom of returning to tillage after the land has for three or four years been laid down to pasture. Here the first corn crop, which is oats, has generally a large quantity of grass amongst it, to save which in good condition is of much importance; they take care, therefore, to cut low, either by scythe or hook, while dry, and to bind the sheaves with the bands rather near the ears; these in fine weather are set up singly for a day or two; then they are collected and built into small round stacks, rather less in diameter at bottom than two lengths of the sheaves, and gradually tapering till finished at the top with one sheaf tied close to the butt, and put on with the ears down so as to thatch all the ears of those below. The builder stands on the ground at first and finishes with a short ladder. If the weather is wet and precarious, the corn is "rickled" close up to the hook, scythe, or machines; the use of the sickle is almost unknown. Wet never penetrates these little stacks, because the sheaves lie elevated at the centre at an angle which becomes higher and higher, until the last sheaf placed vertically makes a cap for the whole. These "rickles" contain

from 100 to 150 sheaves, and cost about 2*d.* per hundred sheaves, or from 1*s.* to 2*s.* per acre for building. When the crop is stacked, before it has stood in the sheaf long enough to harden the grain, a triangle is always formed of three poles about 12 feet long, fastened together at the top. This is raised on the stands with the bottom ends about three feet apart; or, if stands or staddles are not in use, then a stone or brushwood bottom is formed, with an opening leading to the triangle so as to admit free circulation of air; on this bottom the crop is built around the triangle in stacks of from three to five yards in diameter, according to the condition of the corn, and thus the grain is preserved from heating and the straw from damage. In the western and midland counties of Ireland a similar system prevails, with this difference,—that there the crops are all reaped and tied into very small sheaves, and that in building the field-stack, the builder kneels on the stack, which is objectionable, because the sheaves get packed too close, and the wind and air cannot permeate the stack freely.

About thirty years ago, John Love, Esq., of Oakfield, in the county Kildare, invented a plan of making round shocks, with twelve sheaves and four small head sheaves, which, while they resisted the rain, permitted the wind to act on the whole mass; this costs about three halfpence per hundred sheaves. The damage done by these shocks standing too long in one place upon grass-layers in wet seasons, induced the author to invent a simple contrivance, at the cost of 12*s.* 6*d.*, which enabled two men to move these shocks bodily, at 6*d.* per hundred shocks of 16 sheaves each. This contrivance consisted of two bars of ash, three inches in depth by $1\frac{1}{2}$ inches thick, and seven and a half feet long, rounded at the ends for the hand to hold by; two three-quarter-inch round rods of iron, four and a half feet long, are fastened into the flat side of one of these ash bars, at about a foot from each end; corresponding holes being made in the other bar to receive the two rods so that the bars can be drawn close together or slid apart at the will of the carriers. From the inside of the said ash bars project four iron teeth, three inches long, set fifteen inches apart. The carriers set these bars wide enough apart for them to pass over the shock, and lower them to within two-thirds of the bottom; they then press the bars together, and the teeth enter into the shock, which is thus tightly grasped and lifted bodily on to fresh ground. With this simple contrivance two active men can, with a good crop, move shocks at 6*d.* per hundred. When the shocks are few and far between it will cost more.

As we travel from the North of England southwards, or in Scotland from the west, eastwards, we find that these extra precautions die away, until even the practice of putting head-sheaves on the shocks gradually disappears, and the grain and straw are alike left to the mercy of the climate, which of course seldom does

much damage, or the intelligence of the farmer would prompt him to adopt the same means as others to prevent the loss. Still there are occasional seasons, such as those of 1841, 1845, and 1860, in which the plan of making shocks well capped and secure would have saved a vast deal of both grain and straw, which as it was were bleached and damaged. With the present rage for cutting corn green, capping is found to retard the hardening of the grain, and may be dispensed with, if the sheaves, placed with the knots of the bands turned inwards, are made to straddle properly, the ears being well pressed home together, and each pair of sheaves in the shock so adjusted that they can stand alone unpropped, even if some of the other sheaves be removed.

Before entering into the expense of the various operations of which this Essay must treat, it will be desirable to calculate the annual expense of keeping a farm-horse. The keep may be thus estimated :—

		£.	s.	d.
For 32 winter weeks—				
32 bushels of oats, at 3*s.*		4	16	0
32 bushels of beans, at 5*s.*		8	0	0
56 cwt. of carrots, at 1*s.*		2	16	0
Wheat-chaff gratis.				
For 20 summer, &c., weeks—				
20 bushels of beans, at 5*s.*		5	0	0
5 tons of green rye, tares, Italian rye, or clover, equivalent to one ton of hay, at		3	0	0
Total for food		23	12	0
Blacksmith's bill, shoeing and mending traces, &c.	12*s.* 6*d.*			
Harness-maker's, oiling, &c.	7*s.* 6*d.*			
Interest and tear and wear of harness, 10 per cent. upon 3*l.* 10*s.*	7*s.* 0*d.*			
		1	7	0
Insurance of life, with tear and wear on 35*l.*, the value of horse, at 10 per cent.		3	10	0
		28	9	0
Tear, wear, and interest on machines, &c., for preparing food, 10 per cent. upon 1*l.* 10*s.*			3	0
		£28	12	0

Further, as to the rate to be charged for the use of a horse, this ought to vary with the demand for his service at different seasons. There are not more than 250 working days in the year in all. Of these—

	£.	s.	d.
60 days for harvesting and seeds, charged at 3*s.*, will make	9	0	0
90 for manure carting, root-harvesting, &c., at 2*s.* 6*d.*	11	5	0
100 days at slack time, charged at 1*s.* 8*d.*	8	6	8
	£28	11	8

—a sum which agrees with our estimate of the total cost of keeping a horse.

I shall now proceed to the consideration of my subject in reference to the various methods of harvesting practised in England, viz.: reaping high, reaping low, bagging, mowing, machine-mowing, and machine-reaping; in all of which I have had nearly thirty years' experience and close observation. For above twenty years I have been in the habit of taking the number of sheaves, of a given size, as the fairest and best test of the economy of those different systems, in all their bearings, as to cutting, carting, stacking, thatching, and threshing.

I find that a full crop of wheat gives about the following number of sheaves per acre (of from 8 to 10 inches diameter):—when reaped high, 160; bagged, 180; mown, 200; machine-reaped, 170; machine-mown, 180, *for each foot in length of straw.* Oats give about a fifth more; and barley, when free from seeds, a third more, but with a layer often double.

We may take as our standard a crop of wheat, one of about 40 bushels per acre, the straw of which will be about 5 feet long; this, if reaped 18 inches high will give 560 sheaves; which at the price of 1*s.* 9*d.* per hundred, will cost 9*s.* 11*d.* per acre for reaping. The same reaped low, at 6 inches, gives 720 sheaves; and at the same rate, costs 12*s.* 7*d.* per acre.

Bagging should be done so as to leave a stubble 3 inches high, and will in the aforesaid crop produce 855 sheaves, which, at 1*s.* 2*d.* per hundred cost, 9*s.* 11¼*d.* per acre. Mowing is done at about the same height as bagging, at the price of 10½*d.* per hundred sheaves; producing 950 sheaves, and therefore costing 8*s.* 3¾*d.* per acre.

By machine-reaping I mean the work of such reaping-machines as by manual or mechanical power deliver the crop in parcels large enough for sheaves; such are Hussey's, McCormick's, Dray's, and others made on the same model by other makers. Among these Dray's stands foremost, which, with fair management, will cut an average of 8 acres a day, or 120 acres in 15 days, which will represent the average quantity cut in a season. The tear and wear of the implement must be distributed over that number of acres. If this be estimated at 20 per cent. on 30*l.* (the average cost of the reaper, including carriage and extras,) the charge for the use of the implement amounts to 1*s.* per acre on these 120 acres. Three horses will also be required, at 3*s.* apiece per day; likewise two good labourers at 4*s.* each including beer, who take it in turns to drive and to deliver the crop. These together cost 17*s.* for the 8 acres, or say 2*s.* per acre, which with 1*s.* for wear, &c., of machine, gives 3*s.* as the whole cost of machine-cutting and

laying in parcels ready for tying into sheaves. Our standard crop when thus harvested will produce about 810 sheaves, which for tying and shocking will cost $4\frac{1}{2}d.$ per hundred, or $3s.$ per acre; making, with $3s.$ for cutting, a total cost of $6s.$ per acre.

Bell's, Burgess and Key's, Lord Kinnaird's, Smith of Deanston, and Crosskill's, are all swathe-delivery or mowing-machines, which ought to take a wide cut, or the swathe will be so thin that the cost of gathering runs away with much of the saving effected in cutting.*

The differences to be found in the reports of various persons who have used these machines, have arisen chiefly from the different management of their respective drivers, upon which both the increase in bulk of the straw cut, and in the cost of gathering and tying has depended. Having used these machines more or less during the past nine years, I will now give an estimate of their expenses for a swathe of about five feet in width. These machines, with extras and carriage, will cost about $50l.$; if we allow $10l.$ (or 20 per cent. on the prime cost) for wear and tear and for repairs, and assume that 150 acres is the extent which each will cut in an average season,—then $10l.$ distributed over 150 acres will give $1s. 4d.$ per acre as the charge for the use of the implement; to this must be added the cost of men and horses. Now 4 horses at $3s.$ per day as before, and one man at $4s.$ including beer, making together $16s.$, will cut 10 acres a day, so that the charge per acre for men and horses will come to $1s. 7d.$, and the entire cost of cutting to $2s. 11d.$ The number of sheaves on our standard crop will be about 850, which for gathering, tying, and shocking, at $7d.$ per hundred, cost about $5s.$ per acre, with about $3s.$ for cutting; about $8s.$ per acre in all. For upwards of twenty years I have paid for cutting and carting my crops at per hundred sheaves, finding this the best criterion to go by, as the immense difference in the bulk of straw produced by difference of soils, as well as by high or low farming, renders any other standard defective.

Coming next to the carting, I have always had this done at a

* From my experience in this description of machine, which began in 1834, I have come to the conclusion that the power is principally absorbed in driving the machinery and dividing the corn to be cut from that left standing, so that little extra force would be required for taking a foot or two more in width; I have, therefore, urged on the makers the expediency of increasing the width, especially in the machines which are propelled, which, if made with an eight feet wide cut, would give plenty of room for three horses working abreast. As we increase the width of swathe, we at the same time reduce the distance to be travelled by the horses in cutting, and the workmen in gathering and tying up; with a four feet width of cut the horses must travel $2\frac{1}{16}$ miles per acre, and the binders the same; while with an eight foot width of cut the distance is only $1\frac{1}{32}$ mile, or half the distance, which will lower the expense of gathering and binding by at least $1d.$ per 100 sheaves.

halfpenny per hundred sheaves for each hand they pass through until finally laid on the stack; this provides for pitching, loading, unloading, handing to stacker, and stacking, besides a man who sees that the stack is going up all right, and gets on the platform to repitch when the stack gets too high for the man on cart or waggon to reach the top; this gives 3*d.* a hundred sheaves as the expense of manual labour in carting and stacking; the cost of horses and drivers depends on the distance of the stack from the field. A horse will go and return a quarter of a mile in ten minutes (at the rate of three miles an hour); and two loaders and two pitchers will load 240 sheaves in the same time; therefore for every quarter of a mile between the field and stack, an extra horse, cart, and boy will be required; of course intermediate distances must be met, either by more horses going more slowly, or fewer going faster. Inasmuch as expedition (when the crop is fit) is of the utmost importance, and three horses and carts or waggons are the smallest number that can insure the harvest-men against loss of time,—the minimum cost for horse-labour with the drivers will be about two-pence per hundred sheaves, and for every additional quarter of a mile in distance two-thirds of a penny.

A considerable saving of cartage will obviously be effected if for the central farm-steading, which may be called the Scotch plan, there be substituted that of having several field barns. This system has been introduced into England, together with the moveable steam-threshing machines, which have in many parts quite superseded the old method, because they can thresh the corn in less time than was once required to put it into the barn.

Economy in thatching is another point for consideration. This item of expenditure becomes more costly as the bulk of the straw is increased by the use of other implements than the sickle, as the size of the stacks is diminished, as the slope of the top or roof is increased, and as the stacks are allowed to increase in size as they go upwards, which shape also involves an increase of labour, because a greater portion of the sheaves have then to be thrown up above the level of the carts.

The stacks, therefore, should be made of as large a size as circumstances will permit, and this size will be ruled by the number of sheaves which can be threshed in a day, which will commonly be 8000, or the produce of about 10 acres, yielding 40 quarters of wheat; at all events the size of the stacks should be so regulated that one, two, three, or more, should constitute a day's thrashing.*

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* Where small stacks are thought desirable, they should be so placed in pairs that the two may be threshed without moving the machine and engine, and thus sacrificing nearly an hour of work.—P. H. F.

I have been in the habit of building my stacks on staddles 30 feet long and 12 feet wide, the ends being circular. Commencing in the middle, the first outside sheaves are allowed to project 6 inches over the frame, and the next two courses overlap to the same extent, which brings the width to 15 feet; the walls or sides are then carried up so nearly vertical that when 12 feet high the width has only increased by 18 inches; the head or roof is then put on at an angle of 45 degrees, which settles down to about 40 degrees: these stacks hold about 8000 sheaves, reaped low. They require nine square of thatching, costing 1*s.* per square, which comes to 1⅓*d.* per hundred sheaves. If the crop has been bagged, the cost of thatching is about 1½*d.*; if mown, 1¾*d.*; if high-reaped, 1*d.*; if machine-reaped, 1⅓*d.*; if machine-mown, 1½*d.* per hundred sheaves. The thrashing I have found to cost per hundred sheaves an average of 10*d.* for high-reaped sheaves, 1*s.* for low-reaped, 1*s.* 2*d.* bagged, 1*s.* 3*d.* mown, 1*s.* 1*d.* machine-reaped, and 1*s.* 2*d.* machine-mown.

I have put together these various costs in the following table:—

Operations.	Price per 100 Sheaves.	High Reaping 540 Sheaves.			Price per 100 Sheaves.	Low Reaping 720 Sheaves.			Price per 100 Sheaves.	Bagging Low 850 Sheaves.			Price per 100 Sheaves.	Mowing Low 975 Sheaves.			Price per 100 Sheaves.	Machine Reaping 810 Sheaves.			Price per 100 Sheaves.	Machine Mowing 850 Sheaves.		
		Per acre.				Per acre.				Per acre.				Per acre.				Per acre.				Per acre		
	d.	£.	*s.*	*d.*	*d.*	£.	*s.*	*d.*	*d.*	£.	*s.*	*d.*	*d.*	£.	*s.*	*d.*	*d.*	£.	*s.*	*d.*	*d.*	£.	*s.*	*d*
Cutting and shocking .	21	0	9	11	21	0	12	7	14	0	10	0	10½	0	8	6	9	0	6	0	11	0	7	10
Carting and stacking .	4	0	1	9½	4	0	2	4¾	4	0	2	10	4	0	3	2	4	0	2	8½	4	0	2	10
Thatching .	1	0	0	5¾	1⅓	0	0	9½	1½	0	1	0¾	1¾	0	1	5	1⅓	0	0	10½	1½	0	1	0¾
Threshing .	10	0	4	6	12	0	7	2¼	14	0	9	11	15	0	12	1	13	0	8	7	14	0	9	11
Total cost per acre . . .	40	0	16	8¼	38⅓	1	2	11½	33½	1	3	9¾	30¾	1	5	2	27⅓	0	18	2	30½	1	1	7¼
Cutting and carting stubble . . .	..	0	3	9																				
Loss in value of straw .	..	0	9	4																				
Say . . .	..	1	7	9	..	1	2	11½	..	1	3	9¾	..	1	5	2	..	0	18	2	..	1	7	7¾

On all these systems, except that of high-reaping, autumn cultivation can be carried on even between the shocks, if these are carefully set up in straight rows. It may be satisfactorily shown that the saving effected by high-reaping is more than counterbalanced by the cost of harvesting the stubble and by the deterioration of the straw. To prove this point I carefully removed the straw off four square yards of ground and set it up even at the bottom, when I found that the top foot gave at the rate of 6 cwt. per acre, the second 6 cwt., the third 7 cwt., the fourth 8 cwt., the fifth 9 cwt., and the sixth 10 cwt. per acre in round numbers on a full crop. As the standard crop taken for our cal-

culations is 5 feet high, the quantity of straw deteriorated will be 15 inches, which, at 9 cwt. per foot, gives 11 cwt.; this, as straw, is worth at least 1*s*. per cwt. for manure and 2*d*. for litter, or 14*d*. in all. On the other hand, as stubble, its value for manure is diminished by one-half, or 6*d*. per cwt., whilst for litter it is totally unfit, being always cold and damp when so applied. This deterioration, therefore, on 11 cwt. amounts to 7*s*. 4*d*. per acre, to which, if we add 3*s*. 9*d*. for the expense of cutting, gathering, and carting home the stubble, we have 11*s*. 1*d*. as our expense and loss to be added to 16*s*. 8*d*., the cost at harvest-time, or 1*l*. 7*s*. 9*d*. in all; which shows that high-reaping is the most wasteful and expensive of all the methods in use, the reaping-machine being more economical by about 50 per cent., whilst low-reaping and bagging are 9 per cent. more expensive than machine-mowing; hand-mowing being more expensive than any except high-reaping.

As dispatch is of the utmost importance in harvest, the reaping-machine and mowing-machines that take a wide cut must rapidly come into use. The custom of mowing barley and oats, and carting them loose, is most slovenly, and, as far as oats are concerned, very wasteful, besides being at all times injurious to the fodder. Barley, however, is thought by many to malt better when got loose after turning, because every grain will thus receive the same exposure to the weather, and consequently sprout alike; but as the land gets better cultivated and heavy crops become the rule, farmers will be weary of the everlasting job of carrying heavy crops loose, and be induced to tie up more and more every year, even if the barley has been previously left in the swathe till properly weathered.

An opinion is generally prevalent that a great difference in the quality of the straw is effected by climate, and to a small extent this is the case; but far greater differences arise from the condition of the soil as to manurial matter for the nourishment of the crop, and from careful harvesting, by which the scorching heat of the sun and bleaching effect of wet are avoided. The truth of this may be inferred from the small value put upon straw as fodder in those districts, where the slovenly system of mowing and carting barley and oats as loose corn obtains. It is to be hoped that the high price of mutton and beef may cause these farmers to see the vast value of well-saved straw as the most economical means of supplying those fibrous elements of food which are indispensable for ruminating animals. It must be admitted that in a fine harvest barley and oats are more quickly though more expensively saved when loose, because if the crop is tied up and shocked it will require three times as

much fielding before it is fit for the stack and safe from risk of heating.

But as the object of cultivation is to aid nature to produce the greatest possible supply of bread and meat for man, it is surely unwise to sacrifice by mismanagement any of the elements that go towards forming this supply; and it therefore must be right to cut down the crop dry, tie it up dry, and shock it up securely, that it may remain internally dry, however wet the season may be, until it be fit, or until the fine weather comes, that is always given in due season for securing the crops of the farm. We all know that the best hay is made in dry, sunless weather, which shows that the sun deteriorates its quality; we also know that every shower extracts from it some of its flavour and nourishment; yet how often do we manage our straw or grain crops as if there was no value in straw worthy of our consideration! After travelling through all Great Britain and Ireland, as well as the greater part of the continent of Europe, I have come to the conclusion that if there is any unfailing criterion of a backward state of agriculture, it is the quantity of land mown for hay to be consumed on the farm. All enlightened men know that the value of well-got hay for fodder is not more than three times that of well-saved straw. For instance, if we value hay at 60*s.* per ton and straw at 20*s.*, and put one beast to winter on the hay and another on the straw, with 40*s.* worth of oilcake or meal, there is little doubt which will do the best, and produce the most and best manure.

For the convenience of autumn cultivation, all crops should be cut low and shocked up in straight parallel rows, pretty wide apart, so as to allow cultivation to proceed, even though the weather should retard the carting of the crop. It is well known that bagged, mown, and machine-cut corn does not bind so closely in the sheaf as when reaped, therefore the wind and air more rapidly extract the moisture out of the grain and straw of the former than the latter; also that wet does not so readily penetrate the former as the latter; consequently all those crops that are bagged, mown, or machine-cut are sooner fit for carting than reaped ones.

The best situation for stacks is an exposed one, open to both sun and air; and they should not be set too close together, that wind and sun may the more freely operate upon them; also that in case of a fire it may not spread from one to the other; also that the engine and thresher may be set down on the lee side while thrashing out the grain. The best position for stacks is by the side of a good hard road, and if they are long stacks or reeks, the ends ought to stand north and south, that the sun may

shine equally on both sides. We do not believe that the system of setting stacks in the fields where they grow is the most economical; they should be placed on the most convenient spot as near the homestead as three carts, when carrying the crop, can deliver them; on the threshing day the cavings, chaff, and grain will then be within a moderate distance for carting to the straw-barn and granary, and the straw must be stacked till wanted, when it may be carted home by teams when returning from fieldwork.

The working of the portable engine and threshing machine has shown how inexpedient it is to waste a fine day fit for threshing out of doors in carting crops into the barn, to be there threshed; in fact, barns to hold crops in the straw are no longer required, and they should be converted into places for preparing food for cattle, or stalls for feeding, with a good plaster-floored granary above. When new buildings are erected, all that is required as stowage for corn is a granary, which should be erected over a good cart and implement shed. Instead of barns, what is now most required are places for cutting chaff, pulping roots, grinding corn, and breaking oilcake; in fact, a food-factory, where the straw, roots, &c., can be manipulated into food containing all the elements found in the richest feeding pasture, which developes both fat and flesh with economy and despatch: thus we may produce a harvest of beef and mutton equal to the requirement of our fast-increasing population.

Northampton.

XII.—*On the Economy of Carting.* By Peter Love, Northampton.

In the preceding Essay on Harvesting Corn, mention was incidentally made of the great saving in the labour of carting that might be effected by the introduction of field-barns and yards. This subject appears to deserve a separate notice, which will necessarily bring also under our consideration the great practical drawback which arises from the irregular shape of many of our farms.

In order to calculate this waste of labour, a particular case must be taken, under a certain rotation. Let us take that of an arable farm of good strong loam, worth from 40*s.* to 50*s.* per acre, cultivated on a six-course rotation, and suppose its area to be a square mile, or 640 acres, which will give 105 acres for each shift, with 10 over for roads, yards, and waste.

If there be on such a farm one central homestead, the mean distance for carting will be half-a-mile; if four field-barns were

substituted for this, that distance would then be reduced to a quarter of a mile.*

The substitution of four field-barns and yards, even under the most favourable circumstances, would therefore diminish the cartage by one-half. Let us further consider how important an item in the annual expenditure that of cartage may be in such a case as that before us. The rotation on such a farm may be stated as follows:—

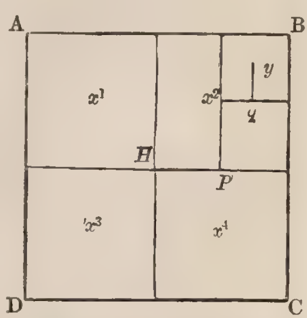
1st year, turnips and swedes.	4th year, wheat.
2nd „ barley.	5th „ half roots, half pulse.
3rd „ clover and grasses.	6th „ wheat.

We shall, therefore, have 3½ shifts, or 367½ acres, in grain and pulse crops, producing straw for litter and manure; and 1½ shifts, or 157½ acres, in roots.

The amount of produce to be carted on such a farm may be thus estimated:—Of the turnips and swedes grown in the first year, 5 tons per acre may be drawn. Again, of the 52 acres of land in roots in the fifth year, we may assume that 20 acres are in mangold and 32½ in swedes. This land will have been highly manured, so that we may reckon on all the mangold and 10 tons per acre of the swedes being drawn and carted. Setting the mangold-crop at 30 tons per acre and the swedes at 20 tons,† the total amount of roots to be carted will therefore be:—

	Tons.
105 acres of turnips, at 5 tons per acre	525
20 „ mangold, at 30 tons „	600
32½ „ swedes, at 10 tons „	325
	1450

* This statement may be illustrated in the following manner:—Suppose A B C D to be the area of a square mile, subdivided into 4 squares or shifts of equal size: then if H be the central homestall, the point of mean distance in each of the shifts will be as at x^1, x^2, x^3, x^4, and if roads at right angles divide the shifts, we may assume that x is reached from H by going on the road to P, and thence over the land to x, and the distance $HP + Px = 2HP = \frac{1}{2}BC = \frac{1}{2}$ a mile. If, however, 4 field-barns were erected at x^1, x^2, &c., the new point of mean distance would be as at y, and that distance $(xq + qy)$ would $= HP$, or $\frac{1}{4}$ of a mile.



† On an average of ten years I grew 36 tons 10 cwts. of mangold per acre; and 23 tons per acre of swedes on an average of thirteen years; the swedes being early sown and the land cultivated nine inches deep; but for a general statement the quantities as given above are high enough.—P. L.

The produce of straw from the grain-crop may be estimated as follows:—

			Tons.
210 acres of wheat, at 1 ton 15 cwt. per acre		.. ..	365
105 „ barley, at 1 ton 10 cwt.	„	.. .. ..	157
52 „ pulse, at 1 ton 10 cwt.	„	.. .. ..	78
	In all	.. ..	602

For the profitable consumption of roots we shall require an admixture of $1\frac{1}{2}$ bushels of straw-chaff with each bushel of roots; or at least 1 ton of straw to 8 tons of roots, supposing, as in our case, that but little hay is made or consumed. From 180 to 200 tons, therefore, of this produce of straw and stover will be required for food; and about 400 to 420 tons will remain for litter, which will be converted into about 1500 tons of manure.

It has been shown in the Essay on Harvesting Corn that harvest-cartage costs two-thirds of 1*d.* per quarter of a mile per 100 sheaves; and on such land as this, there will be, on an average, 850 sheaves per acre over $367\frac{1}{2}$ acres of corn and pulse crops; therefore the extra harvest-carting will, in our case, cost 8*l.* 15s.

The carting of manure and roots in the autumn and winter season, when roads are bad and days are short, is a much more tedious and expensive process, and cannot be set at less than 1*s.* per mile, or 3*d.* for a quarter of a mile. At this rate, the extra carting for a quarter of a mile would cost—

	£.	s.	d.
For 1450 tons of roots	18	2	6
„ 1500 tons of manure	18	15	6
Or together	36	18	0

which, with the extra harvest-carting, 8*l.* 15*s.*, comes to 45*l.* 13*s.*: or, if account be further taken of the saving made in carting green stover and hay, the total saving may be fairly reckoned at 50*l.* a year.

The author has here called attention to the extra cost of carting from distant buildings under the most favourable circumstances which can be imagined. Practically, the admixture of grass-land with the arable (the former being generally laid near to the homestead), the irregularity in the shape of the farms, defects both in the number and direction of the roads, besides the annexation of outlying fields and holdings, tend greatly to increase the average distance of carting, as well as the *extra* distance which might be saved by the erection of field-barns. It may be well then further to direct attention to the very great waste

of power and sacrifice of convenience which has arisen on many estates from the random manner in which the land has become gradually aggregated into irregular holdings.

The size of farms has generally been on the increase, and the tenants, anxious to get a little more land, have been glad to secure whatever chanced to fall vacant, wherever it might be situated; and such makeshifts have been indolently perpetuated.

Meanwhile such a farm as we have been considering will have undergone a great transition. Of such strong land no small portion was probably once in pasture; and it mattered little if the cows had a rather longer walk, or a few tons of hay longer carriage from the field; for the manure-cart never visited the pasture, and the sheep fed on it by day lightly carried off their teething to the night-fold on the arable; bare fallows were in vogue, root-growing little practised and less understood; so that an estimate for carting 1450 tons of roots on 600 acres would have been appalling! From the same change in management, since the amount of manure made depends on the roots consumed as well as on the straw grown, the increase of manure to be carted must also have been considerable. Nevertheless, although the importance of having a compact farm very much increases as agriculture advances, there is often an opposing *vis inertiæ*, which is too great to be overcome by the average desire for improvement.

The person most directly interested in such a readjustment is the occupier of the land, on whom the burden directly falls; so that unless the agent or landlord be unusually energetic and far-sighted, they will not urge a point which will entail on them trouble, debate, and possibly ill-feeling; yet, unless they take the initiative, the question cannot be mooted, and unless they urge it vigorously, it will not be satisfactorily solved. The tenant, however in the abstract he may admit that the fields might lie better and be readjusted with advantage, will still be apprehensive of inconvenience, and suspicious of loss from any proposed exchange of land; his plan of cropping will be somewhat deranged, and never will the virtues of the departed be more highly estimated and extolled, than those of the fields which he is expected to cede to his neighbour. If, then, any proprietor be prompted to review the map of his estate, with a view to removing the most glaring instances of inconvenient allotment of his fields, he should buckle himself up for the task with some strength of purpose. Even in recently enclosed parishes, although the benefits derived from re-allotment were very great, still the redistribution of the land was often very imperfectly conducted, either from the obstinacy of owners and the dread of legal difficulties, or because agricultural interests were but imperfectly appreciated and attended to when this great step in

advance was made. Local attachments, which had then to be respected, may now perhaps have ceased; and, as education has advanced, a power has been gained of foreseeing and estimating the benefits to be derived from a proposed change, which is, generally, entirely wanting in uneducated or ill-educated men. An interesting account will be found in the Journal of the Bavarian Agricultural Society for February, 1860, of the manner in which reallotments and enclosures are conducted in that country. Nowhere does the work seem to be more needed; for in the first revision spoken of, the prime mover of the work had 400 plots of ground scattered here and there, to form an estate of 1500 "Tagwerke," and these were exchanged for seven fields. But nowhere does the kindly, genial temperament of the nation appear to greater advantage; for by the aid of a government district-engineer, the matter is amicably arranged, in spite of attempts at overreaching, without legal proceedings, and a cross is erected and consecrated to commemorate the auspicious event. The force of public opinion is probably brought to bear on impracticable opponents, for one Hagel is denounced as such; and, at the same time, proprietors who show liberality and public spirit are suitably mentioned: but happy is that society in which such influences are sufficiently telling to prevail over the general selfishness which among ourselves is mostly tolerated, if not recognised as natural, and, in some sort, right.

In England, although the work of enclosing is almost complete, there are still many estates on which in no other way could so great improvements be made at a moderate outlay of money, time, and thought, as by a judicious readjustment of the different holdings. It is a work, however, that will try the temper, discretion, and practical knowledge of the agent. If he work by the map only, or if he be too impatient and dictatorial to listen to suggestions, or too ignorant of practical details to appreciate the tenant's explanations; or again, if he be not firm enough to carry through a well-investigated measure in the face of some opposition; he had better remain quiet, and——draw his salary. If he does his work well, his best reward will be, when the sturdy, honest, illiterate man, who put up his back most resolutely against these changes, in a few years admits handsomely and publicly the great good which they have done.—P. H. F.

XIII.—*Destructive Insects and the Immense Utility of Birds.* Extracts from a Pamphlet dedicated to Agricultural Societies and Schools. By FREDERIC DE TSCHUDI, President of the Agricultural Society of Canton St. Gall, Switzerland. Translated from the Second French Edition, by HENRY L. B. IBBETSON.

THAT we may the better understand the importance of birds to mankind, let us examine the lives and habits of these little creatures, and the position assigned to them in the marvellous economy of Nature. A simple view of their organisation and mode of life will at once show us that the orders of birds whose daily and principal food is drawn chiefly, if not entirely, from the animal world, are those which exist both in the greatest numbers and the greatest variety. In Germany and Switzerland 150 different species are known, some sedentary, others more or less nomadic. The most numerous order of all is that of the Insectivora, which includes the warbler (*Sylvia orphæa*), the yellow wren (*Sylvia trochilus*), the stone-chat (*Saxicola rubicola*), the lark (*Alauda*), the Alpine warbler (*Accentor Alpinus*), the white wagtail (*Motasilla*), the fieldlark (*Anthus arboreus*), the great titmouse (*Parus major*), the spotted flycatcher (*Muscicapia grisola*), the throstle (*Turdus musicus*), the great cinerous shrike (*Lanius excubitor*),—the order numbering altogether more than 80 species. Few of these eat vegetable food, by far the larger number living exclusively on animals. The next most numerous order—that of the Palmipedes—of which there are about 40 species (some of which are rarely seen in these countries), also lives for the most part on animal food. Swans do not disdain it; geese are the only members of the order which steadily refuse it. The Grallæ, which form a group of about 30 species, are almost entirely dependent on animal food. Birds of prey—Rapaces—numbering as many species as the preceding order, of course feed exclusively on animals; whilst of the family of the Gallinæ, in which there are about 20 known species, the following members prefer animal food:—the water rail (*Rallus aquaticus*), the common loot (*Fulica atra*); the partridge (*Perdix*), wood-grouse (*Tetruo*), bustards (*Otis turda*), do so at certain periods. The Zygodactyli, consisting of 12 species, are very eager after animalculæ; the European nuthatch (*Sitta Europæa*), the wryneck (*Yunx torquilla*), and possibly the woodpecker (*Picus*) and cuckoo (*Cucullus canorus*), being the only ones which in autumn eat berries and seeds. The order of Granivora, which includes the families of the chaffinch (*Fringilla*), the house-sparrow (*Fringilla domestica*), the serin-finch (*Fringilla serinus*), the linnet (*Fringilla lissota*), the bunting (*Emberiza*), the haw-

finch (*Loria locothraustes*)—in all about 30 species—have not a full right to the name which their order bears, since all the buntings, all the chaffinches, and all the sparrows consume during the summer as much animal as vegetable matter, if not more. The only birds which feed exclusively on vegetables are the pigeon tribe, including about 5 species.

Thus one order only, comprising but one single family, together with a few scanty families taken from other orders, forming when put together but one-twelfth or one-thirteenth part of our birds, constitutes the total of those which exclusively consume vegetable food. There is also another fact not devoid of interest to the agriculturist, viz., that the Granivora principally choose and prefer the seeds of obnoxious plants, of which they destroy vast quantities.

This rapid survey is suggestive of highly important considerations. It brings under our notice the great and invariable harmony existing in Nature in the distribution of the earth's produce; for when we come to consider the sort of animal food that birds make use of, we cannot deny that they tend to the preservation of the vegetable kingdom. In effect, all the Insectivora, the Zygodactyli, the Grallæ, nearly all the Palmipedes, the species of Gallinæ and of Corvi, a part of the Granivora, and even the greater number of the Rapaces, either feed exclusively or partially on those classes of animals, such as beetles, caterpillars, larvæ, flies, Neoroptera, Hymenoptera, Rhinosimus, spiders, Crustacea, worms, and Mollusca, which by their extraordinary powers of reproduction threaten, and sometimes more than threaten, to destroy the vegetation existing on the earth's surface. Many of the larger birds feed also on mice and reptiles, which, though insectivorous themselves, would end in being troublesome through their numbers. Truly Providence does not, to our mind, always make use of the simplest and shortest way of realising its object; but its views are themselves so varied, that innumerable agents are constantly at work to secure the end. It unfolds itself in a thousand different shapes, and displays its wealth in apparently contradictory contrasts. Thus in the Insect world we meet an assigned limit, combined with infinite variety of form and immense profusion of species. Like Birds and Mammalia, it possesses its Herbivora and Carnivora most wisely distributed. Where vegetation is most luxuriant, we find more Coleoptera than Phanerogama; and amongst these beetles the Herbivora predominate. In mountainous districts Phanerogama surpass the Coleoptera in numbers; whilst in the higher regions of the Alps, these last disappear long before the former; and amongst the insects and spiders which exist beyond the limits of eternal snow the Carnivora are more numerous than

the Herbivora, this arrangement being evidently for the express purpose of protecting these last and scanty remnants of vegetation.

The vegetable world is the base on which the higher orders of creation are built up. Without plants, animals cannot exist; for even the Carnivora are indirectly dependent on vegetation. If Providence is pleased to produce innumerable hosts and varieties of the smaller animals, it imposes, as it were, a certain limit on itself, by proportionately and gradually placing, where necessary, numbers of Carnivora; and if the wide-spread tribe of birds be destined to feed on animals of an inferior order, it thus provides a means for the maintenance of a perfect balance between the protectors and destroyers of vegetation. Birds are Nature's soldiers, and keep in subjection the inferior animals. If some amongst them constitute an excellent part of the food of man, furnish him with eggs, with useful feathers, or with a good manure, all these services are scarcely worthy of notice when compared with their labours in the destruction of insects. For this especial duty the most essential of their organs have been adapted—their sight is piercing, and even the very smallest among them possess the most extraordinary powers of digestion—whilst their great activity and lightness enable them to exercise their calling incessantly and where most required. The reproductive powers of birds and their instinct of migration are also due to the office imposed upon them. When in the North the insect world drops into its wintry repose and sleeps under layers of deep snow, then most of the bird tribe fly to the South, there to perform the same duties; whilst those which remain all the year round in one place gather up the larvæ, the eggs, the nests of insects, the few flies or spiders which may be tempted out of their holes by a sun-ray, and the Coleoptera which gnaw the barks of trees.

In these days it would almost appear as if the great and important services rendered by birds were insufficient for the purpose; for complaints are heard from Germany and Switzerland that they are invaded by swarms of those varieties of destructive insects which are habitually seen in small numbers only. They lay waste green meadows, vegetable-gardens, crops of wheat or flax, fruit-trees, and forests; they torment alike animals and men, take us by surprise, and destroy our prospects. Amongst the beetles, the cockchafer is our most declared enemy. When in its last stage of development it destroys the blossoms and leaves of trees; but, still more dangerous in its larva state, it gnaws the roots of plants, and, appearing in alarming masses, often devastates whole countries. This beetle might be made of use, in more ways than one. In the first place, its carcass is an active manure, a good food for fowls, or, if well dried, even for cows, whose milk it will then increase.

Some chemists have succeeded in extracting from them a good brown colour and a good Prussian blue; much oil, too, can be got out of them, 16 measures of cockchafers giving 6 measures of oil. A clear gas and a fair sort of cart-grease may also be manufactured from them; whilst cooks even turn them into a nourishing and savoury soup, or a sweetmeat for dessert.

All this is doubtless very well in its way, but if we do not steadily persevere in our labour of limiting, to the utmost of our power, the number of cockchafers, they would in the long run ravage so many lands that neither hens, cows, cooks, nor chemists could by any possible means exist. Other destructive beetles are the *Acanthopoda*, the *Astynomus œdili*, the *Anthonomus*, the *Bostrichus typographus*, which in 1780 and the following years destroyed more than a million of fir-trees in the Hartz Mountains and in Switzerland, and more recently committed other awful depredations; and lastly the *Hydrophilus atei*, a very dangerous insect for preserved fishponds. Several species of butterflies, otherwise so innocent, belong when in the caterpillar state to the class of pernicious articulated animals; the principal of these are the *Bombyx processionea*, the *Phalena bombyx*, the *Pieris*, the *Lasiocampa*, the *Phalena*, the *Neustria*, and the *Tinea*. As for the other sorts of inferior insects, such as the *Gryllotalpa*, the *Aphis*, the grasshopper, the ant, different species of the gadfly, wasps, flies, worms, and snails, it is almost needless to speak of them; they are but too well known as plagues. The *Acridium migratorium* has already penetrated into Southern Switzerland, and we are forced to come to the conclusion, from observations carefully made on different spots, that the number of destructive insects in general is gradually augmenting. This arises evidently from the diminution of insectivorous birds, which is in exact proportion to the increase of insects; and if we look into the causes of this diminution we shall find more than one, both in this and other lands. Generally speaking, the progressive cultivation of the earth is not very favourable to animals living in freedom. It has driven the fallow deer from our woods; the elk, the lynx, the wolf, the bear, the ibex, from our mountains; the beaver from our rivers. But it has been especially hostile to birds; the hospitable thickets diminish yearly; man forces onward the limits of his domain; he masters the as yet uncultivated soil, and draws from it rich harvests. Large tracts of woodland are cleared to supply the wants of an increasing population and the heavy demands of industry. The large trees formerly left standing in the midst of a field, in which numberless small animals found a refuge, are made away with, or replaced sometimes by the small fruit-tree. Long rows of hedges, the hidingplace of a whole host of birds, meet with the like fate;

and these, too, were of other use, for they attracted quantities of caterpillars, which fed on their green leaves, and thus spared the orchards. All the little nooks so useful to birds, both as hatching-places and hunting-grounds, disappear one by one. In woods, the mistake of cutting down right and left old trees full of small holes, has been, unfortunately, understood too late, and thereby numbers of the best Insectivora have been deprived of commodious nesting-places: unavailing regrets from those incessantly exposed to the havocs of wood-insects will follow on the disappearance, for years to come, of their best and most active allies of the forest. United, the causes we have just referred to would alone be sufficient to explain the heavy and sensible diminution of small birds; but there are others of considerable consequence, for instance, the frequent netting and shooting by man, and the destruction of nests by children and cats. In some countries no nest is out of reach, and none are left unplundered; and it is especially the most useful destroyers of insects which are plundered in quantities, such as the titmouse, the chaffinch, the warbler, and the redbreast. Nightingales in some places have become so very scarce, that in spots formerly enlivened by their songs every spring, they have not been heard for more than ten years. Here and there the absurd ordinances, enjoining every government keeper to destroy woodpeckers and cuckoos, and even offering a premium for every head brought in, are still the law of the land.

But the cause which exercises a still more fatal influence on the diminution of our most useful birds of passage, is the exterminatory hunt they are subjected to on the part of Italians. It is a well-known fact that at the period of their spring migration, and still more in autumn, Italians are seized with a mania for killing small birds. Men of all ages and conditions, *nobili*, merchants, priests, artisans, and peasants, all abandon their daily tasks, to attack, like banditti, the troops of passing visitors. By the river-side, in the fields, all around is heard the report of fire-arms; nets are laid, traps set, twigs covered with bird-lime hang on every bush. On every hill adapted to the purpose is placed a sort of trap (*roccolo*), full of owls and sparrow-hawks, to attract and slaughter the little stranger. The objects of their pursuit are not those birds which in other countries are usually chosen for purposes of sport; on the contrary, they select the little Insectivora, the singing-birds, and particularly the nightingales. Swallows even—birds generally protected by man—are taken in quantities, and often in a most cruel manner. A small insect or feather is attached to a hook, held by a long thread, and allowed to float in the air, to attract the swallow as it skims past. To form some idea of the

slaughter which for weeks together is the chief delight of the population of Italy, it is sufficient to mention that in one district on the shores of the Lago Maggiore, the number of small birds annually destroyed amounts to between 60,000 and 70,000; and that in Lombardy, in one single *roccolo*, 15,000 birds are often captured daily. In the neighbourhood of Bergamo, Verona, and Brescia, several millions of birds are slaughtered every autumn, and the exterminatory fever rages quite as violently in the more southern districts. In Sicily, for instance, during ten days in autumn, nearly 1,000,000 of larks arrive daily on the coast, and immediately on their appearance are met by a continuous file-firing from hundreds of sportsmen, who bring them down in thousands.

This purely Italian* mania has penetrated into Switzerland, in the Canton Ticino, where no prohibitory laws exist to prevent the increasing fondness for the sport; the inhabitants entrap on the frontiers of their canton, on the St. Gotthardt and the Grison mountains, as many of the songsters, when they attempt to migrate, as they possibly can. But we on this side the Alps especially suffer from such wanton proceedings, and we witness the consequences in our fields and woods. We cannot prevent the Italians from indulging in their absurd and barbarous amusements, but we can lessen the evil in some degree; and it would be but consistent with the proverbial good sense of us Germans if we were to protect all the bird tribe with a solicitude proportionate to the mad attacks made upon them southwards, and thus in some degree reinstate the order of Nature, and aid in re-establishing the necessary balance between the insect world and its enemies. We have two ways of accomplishing our object—by favouring in divers manners the propagation and increase of our most useful sedentary birds, and by affording good asylums and hearty protection to birds of passage during their summer sojourn.

It is, however, preposterous to depend entirely on artificial means for a complete restoration of Nature's laws; the force of reproduction is so prodigious amongst inferior animals, that man will never be enabled to combat alone successfully their periodic invasions. On the borders of the Rhine, the *Attelabus bacchus* damages the vineyards, and the *Anthonomus* and *Phalena* the fruit-trees, to an extent which may be valued at several hundred thousand thalers (3*s*.) annually, without a remedy against such havoc having as yet been found. Near Torgau, several thousand thalers have been annually expended on the forest of Annaburg,

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* M. de Tschudi forgets to mention the passion for *mauviettes* existing in the South of France, which national dish is nothing but a fry of every description of small birds.—*Note of English Translator.*

for the destruction of caterpillars and chafers, in the attempt to save the trees from utter ruin. During the year 1837, an area of 860 acres of fir-forest was entirely stripped of its leaves by the caterpillars of the *Noctuæ*, and Government paid more than 1000 thalers for the destruction of 94,000,000 of the above dangerous insects. The havoc these insects cause is almost incredible. Some time ago caterpillars devoured all the grass over immense districts in America, and it was found necessary to import hay from England. The Herbivora caterpillars laid bare the plains of Lesch, near Augsburg, gnawing the roots of every plant, and destroying the herbage growing for miles around several villages. The caterpillars of the *Noctua plenipeda* will in a few weeks' time destroy 300 acres of woodland; and in the Marches of Brandenburg, in two years, they devastated a seventh part of all the Government forests. In Franconia, the caterpillars of the *Bombyx* and *Lasiocampa*, during the year 1839, completely devoured the produce of 2200 acres of Government forest, in spite of the strenuous efforts made to combat the evil. A success was obtained in the woods of Stralsund, where in 1840 Government, at an expense of about 3200 thalers, collected 1000 pounds' weight, that is, more than 633,000,000 of the eggs of the *Bombyx*. The vegetable-consuming caterpillar occasionally appears in such numbers, that a tubful of them may soon be collected. They arrive in a field, quickly destroy the chief part of the crop, and then journey on, it being impossible to arrest their progress. It has been noticed in the Duchy of Hesse, that these insects principally laid waste those spots where, from the want of trees, the aggregation of singing-birds is prevented; and here all human efforts at prevention have been found totally unavailing.

For about half a century the culture of fruit-trees has been steadily increasing in Wurtemburg, so that now it brings in a revenue of 1,700,000 florins (141,750*l.*) annually, though a great part of the crop is yearly devoured by caterpillars. Formerly but little notice was taken of these invaders, but latterly they have so much increased that many cultivators have been discouraged from continuing their occupation. Government has ordered all the trees to be cleansed, both in spring and autumn, imposing penalties for disobedience, but the desired result has not yet been obtained. If Nature did not interpose, man would of necessity succumb; but these insects are pursued by other enemies who become the allies of man. The *Ichneumon* pricks the caterpillar to death, the *Limex* sucks out its vital organs, beetles eat them, principally the pernicious *Processionea* caterpillar; and the shrew-mouse, the hedgehog, the mole, the lizard, the frog, the toad, and the bat are all excellent insect-hunters. Nature, however, has shown most solicitude for us by appointing, as the food most

sought for by birds, eggs of caterpillars, larvæ, caterpillars, butterflies, flies, gnats, aphis, ants, snails, worms, &c., and by giving to each species its assigned duty and place in the work of destruction. Each has its appointed spot, either in the wood, field, bush, meadow, garden, or vineyard, on the rocks, or by the river-side; some attack one particular class of insects, others another; some are clever at pecking them off leaves or branches, others snatch them up as they fly through the air; some unearth them, others extract them from betwixt bark slits, or pierce the wood that shelters them. Each sort of bird is expressly formed for the task it is intended it should perform, in the varied shape of the beak, feet, and wings; and each little workman finds it necessary for its sustenance to swallow daily an amount of matter equal to the weight of its own body.

In order duly to appreciate the immensity of the work undertaken by birds, we will just notice a few facts brought under our observation. In a green-house, three full-grown rose-bushes were covered by about 2000 of the aphis; a blackcap (*Parus palustris*) was introduced, and allowed to roam about in freedom, and in the space of a few hours the whole multitude of insects were consumed, and the plants thoroughly cleansed. The titmouse fortunately multiplies considerably; they render great service, chiefly to shrubs and fruit-trees, eating up millions of caterpillar-eggs. Everyone is aware of the enormous quantities of eggs caterpillars lay at one time, some species 150, and others 500, 600, and even 800. The *Noctua*, for example, lays about 600 eggs twice each summer. The titmouse, like most other birds, does not attack the hairy caterpillar, but it daily swallows thousands of its eggs. Constantly in full activity, both in summer and winter, they are ever rummaging about trees, sometimes in small groups, and sometimes accompanied by the European nuthatch (*Sitta Europæa*), the common creeper (*Certhia familiaris*), and the gold-crested wren (*Motacilla regulus*). They creep into rolled-up leaves, under branches and trunks of decayed trees, and diligently make away with every insect-egg they may chance to stumble upon. Count Casimir Woszicke mentions a conclusive example of the signal services these birds render to our gardens:—

"During the year 1848 an enormous quantity of the *Bombyx dispar* (the well-known enemy of gardens, and which also commits serious depredations in woods) had devoured the foliage of my trees, so that they were quite bare. I discovered in autumn millions of eggs enveloped in a silky sort of covering, and attached to the trunks and branches. I had them removed at a considerable expense, but soon became aware that the hand of man was powerless to ward off the infliction, and resigned myself to the loss of my best trees. But on the approach of winter several bands of the titmouse and the wren (*Sylvia troglodytes*) paid daily visits to my trees, and soon the caterpillar eggs were in a fair way of diminution. At spring-time about twenty couple of the titmouse built their nests in my garden; the ensuing summer the depredations of the

caterpillars were greatly lessened, and in 1850 my little winged gardeners had so well cleansed all my trees, that, thanks to their labour, I had the satisfaction of seeing them in full leaf the whole of the summer."

The indefatigable wren, which remains with us during the winter, is of very great use, for its appetite equals its activity. They must perpetually be swallowing something, and accustom their young to follow their example in gluttony, by feeding them on an average, thirty-six times every hour with insects' eggs, larvæ, &c. A hungry redstart (*Sylvia tithys*) captured in a room, during the space of an hour, 600 flies; and if this little animal hunts but for two or three hours a-day, we may guess the number of its prey. The swallow and the martin (*Cypselus*) in the daytime, and the European goat-sucker (*Caprimulgus Europæus*) during the night, capture swarms of gnats; the chaffinch, the jay, the jackdaw (*Corvus monedula*), devour the *Lasiocampa* and *Noctua.* Even sparrows may be included in the list of useful birds, notwithstanding the damage they cause at times to the orchard or corn-field, because they feed their young (which have very good appetites) exclusively upon larvæ, grasshoppers, caterpillars, beetles, worms, or ants; and both old and young at the end of summer are constantly filling their crops with the seeds of weeds. A couple of sparrows will consume in food for their young about 3000 insects weekly, each parent bringing a billful thirty times an hour. These services are well worth a few cherries. The field-sparrow does not, moreover, eat cherries, and a small number of these birds will soon cleanse many shrubs and rose-trees from the aphis.

Frederick the Great, king of Prussia, being very fond of cherries, one day ordered a general crusade against the sparrow tribe, some of them having ventured to peck at his favourite fruit. A price of 6 pfennings a brace was set on them; consequently throughout Prussia the war was briskly carried on, and so successfully that at the end of two years not only were cherries wanting, but most other fruits. The trees were covered with caterpillars, and completely stripped of leaves; insects had increased to a most alarming extent, for other birds had been frightened away by the extraordinary measures taken mainly against the sparrows. The great king was obliged to confess to himself that he had not the power to alter that which had been ordained by a still greater King than he, and that all attempts at violence and wrong were sooner or later avenged. He retracted his decree, and was even obliged, at a considerable expense, to import sparrows from afar; for these being birds of obstinately sedentary habits, would never have returned of their own accord. When field-sparrows feed in a corn-field they ought merely to be warned off, not killed, unless, indeed, there be many insecti-

vorous birds near at hand. Sensible gardeners every year more and more discourage the slaughter of sparrows.

All the species of warblers (*Sylvia orphæa*), the red wren (*Arundinacea*), the yellow wren (*Sylvia trochilus*), the white wagtail (*Motacilla alba*), the stonechat (*Saxicola rubicola*), as well as the different sort of shrikes (*Vanius*), are excellent insect-hunters, and particularly the spotted fly-catcher (*Muscicapia grisola*), which bird it is better to keep at a distance from bee-hives, whose vicinity it frequents. In vineyards the blackbird does not compensate by its services for the damage it causes to the crop; but in other places they ought to be protected, for they devour numbers of the destructive earth-caterpillar—a task also performed by the agile common stare (*Sturnus vulgaris*), which likewise delivers cattle at pasture from worms, flies, gadflies, &c.

Swallows are most active insectivora—we should therefore protest against the custom of capturing them for food, which prevails in some parts of Germany; we should intercede also for the lark, who, though of use to the agriculturist, finds here an implacable enemy in man. We will now just take notice of a few of the larger class of birds, which are of very important use to our different sorts of culture. The cuckoo is the first on the list. Nature has formed this very remarkable bird for the express destruction of hairy caterpillars, which other birds cannot eat, and has organised its stomach for the easy digestion of such food. In 1847 an immense forest in Pomerania was on the brink of utter ruin, caused by the havoc of caterpillars. It was suddenly and very unexpectedly saved by a band of cuckoos, who, though on the point of migrating, established themselves in the place for a a few weeks, and so thoroughly cleansed each tree that the following year neither depredators nor depredations were to be seen. The cuckoo, like the smaller insect-eaters, eats all the day long, for the caterpillar is full of watery matter and contains but little solid nutriment. By careful observation it was ascertained that the cuckoo devours one caterpillar every five minutes, or 170 in a long day. The hairy stuff sticks to the mucous membrane of the bird's stomach, so as often totally to cover it. If we assume that one-half of the destroyed insects are females, and that each contains about 500 eggs, one single cuckoo daily prevents the reproduction of 42,500 destructive caterpillars. How many men could do the like in one day?

The race of woodpeckers almost rival the cuckoo in utility, and, though unappreciated, are the good genius of our woods. They are full of vigour and courage. When we pass under a tree, how eagerly they look down upon us, seriously and attentively, with their clear brilliant eye! almost saying, "Friend, dost thou

well comprehend the full utility of the work we have on hand? if not, pray be attentive and bear witness to it hereafter!" Their chief victims are very mischievous insects, such as the *Noctua*, the *Lasiocampa*, the *Sphinx pinastri*, the *Tisodes pini*, the *Hylurgus piniperda*, &c. The green woodpecker (*Picus viridis*), and the greyheaded woodpecker (*Picus canus*), are especially distinguished for their skill in putting to death wasps, whose sting avails nought against them. The greater spotted woodpecker (*Picus major*), is ever on the look out for insects and larvæ; the three-toed woodpecker (*Picus trydactilis*), as well as the great black woodpecker (*Picus martius*), much prefer the *Coleoptera libriola.* Another important item in the history of those birds lies in the fact of their being the forest-bird carpenters in ordinary. Every woodpecker, in the course of the year, drills at least a dozen holes in the trunks of trees, not only constructing as commodious and pretty a nest for hatching as possible, but also resting-places in which he lodges for a few nights at the period of migration; when at his work shavings several inches in length are observed to drop to the ground; and in such like cavities hosts of small insectivorous birds find convenient retreats for laying and hatching fully prepared ready to hand. It is acknowledged that this operation of the woodpecker causes no injury to woods, as they on no account work upon healthy trees, but prefer decayed ones which are beset by insects.

Even amongst birds of prey (*Rapaces*), many insectivora are to be found, and such of them are worthy of protection. All the smaller birds of prey, and some of the larger ones also, feed their young on insects, and they themselves, when hatching, hardly touch anything else. The most useful members of the order incontestably are owls, which being extraordinarily gifted for the work, devour in their twilight haunts considerable quantities of forest insects, principally night butterflies and their caterpillars. Some species of the owl are noted, together with the rook-crow (*Corvus frugilegus*), the jackdaw, the jay, and the great cinerous shrike, for their destruction of cockchafers. A tawny owl (*Strix stridula*) was once dissected at Berlin, and its stomach discovered to be full of insects, and amongst these were at least 75 caterpillars of the *Sphinx pinastri;* in the destruction, as well, of field mice and rats they render services whose importance is but seldom recognised. The English naturalist, White, once watched for a length of time a pair of white owls (*Strix flaxinea*), and noticed that they brought a mouse to their nest, on an average, every five minutes; a couple of the little owls carried to their young eleven mice in the course of an evening in the month of June. Nothing is more absurd than the way in which these birds are hunted down by ignorant ploughmen, whose chief

delight is to have a few of them nailed up against the barn-door; they might as profitably nail up their cats (who frequently snatch up a fowl or two), for the owl nightly makes away with more mice than the very best of cats. In the stomachs of 20 dissected owls nothing was found but mice and moles; the great-eared owl (*Strix bubo*), is however much less deserving of our sympathy, for besides frogs, serpents, lizards, mice, &c., this bird often falls upon barn-door fowls, and useful quadrupeds. A great number of diurnal birds of prey, such as the sparrowhawk (*Falco nisus*), the kite (*Falco milvus*), and the harpy (*Falco rufus*), are mischievous, for they slaughter indiscriminately the more diminutive useful birds, and even the smallest of their class devours as many birds as insects. Still the kestril falcon (*Falco tinunculus*), not at all a scarce bird with us, eats so many beetles, grasshoppers, and field-mice, that its utility in this respect amply repays the harm it may cause. The same description is applicable to the hobby falcon (*Falco sabbutes*). A flight of these last birds lately passed over the Canton de Vaud, and alighted on the trees standing round the village of Nouvion. The inhabitants, fancying them to be pigeons, killed a few; but when they saw the eagerness with which the bird sought after and devoured cockchafers, they soon desisted from their ignorant amusement. The most useful, and at the same time most common bird of prey is the common buzzard (*Falco buteo*), so often mistaken for the injurious goshawk (*Falco palumbarius*); it destroys immense quantities of rats, mice, snakes, &c. More than 20 mice have been found at one time inside one of them, and Steinmuller once dissected a bird of this class, and found no less than 7 *Angis fragilis*, and 13 *Gryllotalpæ* in its stomach. The annual consumption of one single bird has been computed at about 4000 mice. Perched upon a bush or high stone, the bird watches for hours the precise instant when the mole or rat approaches the surface of the earth; it then eagerly drops down, inserts its claws deeply in the soil, and snatches up the animal. The brown mark around the belly, and the heavier flight are signs sufficient to distinguish it from the terrible goshawk; these marks ought to be attentively studied. The honey-buzzard (*Falco apivorus*) is also a great mouse-eater, besides which, it also swallows caterpillars, wasps, and horseflies, hooking them out of their nests, and devouring them together with their eggs. These two last-mentioned buzzards are certainly hurtful to other birds, but their utility compensates for all mischief; besides they are heavier, slower, and less alert than the goshawk, and therefore do not destroy nearly so many victims.

It is not my intention here to call attention to all the useful birds in detail, but merely to some of the most remarkable of

them, with a view to showing how great is their importance to all branches of agriculture. Without these creatures, agriculture and vegetation would be impossibilities; they perform a work which millions of human hands could not do half so completely.

We have yet to treat of an order of birds, numbering several families, which appear in great numbers and play an important part in the economy of nature,—we mean the crow (*Corvus*). It is difficult to judge them all in one body, for the different species vary in their mode of life. The jay belongs to this class, which destroys quantities of insects, but damages the seeds of forest-trees, and attacks nests of small birds, devouring their eggs and young; it is remarkable also for its destruction of venomous vipers. The jay is hurtful to many crops; it has been seen to tear off a wheat-ear whilst in full flight and swallow it whole. The same may be said of the carrion crow (*Corvus corvus*), which at the laying period, behaves like a real bird of prey, and carries off quails, young ducks, partridges, and even leverets. The great raven (*Corvus corax*), still more closely imitates the birds of prey, and equally carries off young hares and rabbits, but it has one great redeeming point in its character, that of making away with dead and putrid carcasses. Magpies decidedly do more harm than good; voracious and cunning, they do not rest satisfied with young birds merely, but hunt perpetually those of all ages; the magpie therefore may be shot without compunction. The most innocent and useful members of the above order are the jackdaw (*Corvus monedula*) and the rock crow (*Corvus frugilegus*), which feed a good deal on cockchafers, snails, earthworms, mole-crickets, and mice; therefore the two last species may be encouraged, whilst the rest ought to be kept in check if inclined to multiply rather too rapidly. Those few birds which live exclusively on vegetable products appear at first sight to be hostile to mankind, and to harm the cultivator. This apprehension is more imaginary than real; man is too much inclined to forget the great indirect profit he derives from the Granivora, and only to look upon the damage they cause at certain periods. Do they not destroy quantities of the seed of all sorts of weeds? And how can the agriculturist (as happens in most countries) look upon the wood-pigeon as a real plague? Let him but take time to observe how those birds consume the seeds of the nigella, the wild poppy, and several noxious varieties of the euphorbium, which no domestic animal can eat, as noticed by Glauser. For the above reason pigeons are now strictly preserved in Belgium. The crossbill (*Crucirostra*), and the liskin (*Fringilla spinus*), eat, it is true, many seeds of trees, but they also consume great quantities of burdock seeds; others again of the Granivora, the twite (*Fringilla linasia*), the brambling (*Fringilla montifringilla*), &c., eat abundantly of

the seeds of plantain, wild poppy, burdock, chickweed, groundsel, sowthistle, and other noxious weeds. The bullfinch (*Pyrrhula*), on the contrary, commits depredations amongst blossoms, whilst the haw-finch (*Losia locothraustes*), despoils cherry-trees to get at the kernel of the fruit; these two last species, however, do not often come in our way.

This rapid survey of the economy of nature is sufficient to convince us that we have numerous and vigorous auxiliaries always at hand to arrest the ever-threatening invasions of insects; it is our duty to aid their increase and employ their energies for the advancement of agriculture. We must begin then by abstaining from shooting useful birds, by favouring their reproduction, and by familiarising them with our persons; bird-netting is an abuse unfortunately too frequently indulged in, but it ought to be banished from the vicinity of all cultivated lands, as being extremely detrimental to agriculture. If one only reflects how much the little creatures help to enliven our fields and gardens with their gay chirruping, their fine plumage, their active and lively ways,—and how many victims are sacrificed ere one is secured to bear for a few short years the imprisonment of the cage,—it is utterly impossible to feel any sympathy for bird-catchers. If sport is to extend beyond the birds required for our use,—if children find an amusement in entrapping the titmouse, the warbler, the nightingale, the chaffinch, the lark, the redbreast,—is it not both a sin and a great folly? and will not the inevitable result be the total loss of our harvests and fruits? Why should we criminally interfere in the Divine organisation of Nature? why slaughter our firmest allies? why lift our hands against our benefactors and protectors? If woodmen and peasants could be made to understand the immense services the cuckoo, the owl, and the woodpecker render to mankind, they certainly would protect those valuable servants from the senseless destruction they are subjected to.

The governments of many German States have issued ordinances to prevent the indiscriminate slaughter of singing birds; this very good example has been set by Hesse, Baden, Wurtemburg, and Prussia. In Saxony a heavy fine is imposed on any person found capturing a nightingale, and for every bird kept in a cage a tax of 5 thalers (15*s.*) is levied. This law does not extend to Saxon duchies, nor the forests of Thuringia, where in every village no inhabitant is without his caged songster, and some have as many as 30 or 40 different sorts: free nightingales are therefore getting scarce there, and insects numerous. Many men of sense, such as Lenz of Schrepfenthal, Gloger of Berlin, Schott de Schottenstein of Ulm, have zealously employed their talents for the protection of small birds, and have further advocated attention to their increase. This is an important object which

every one may in some degree promote. Every owner of a wood, field, or garden, ought to spare old trees, in the cavities of which those birds who prefer hatching in obscurity (such as the titmouse, the common creeper, the wren, the owl, the common stare, the grey redstart, the woodpecker, &c.), would find a proper asylum. If the dry leaves and detritus be taken out of such holes, and if when they run perpendicularly down the trunk, a small board with an opening of about 2 inches in diameter be nailed over, they will soon be peopled, and in a few hours the lodgers will amply repay the pains taken on their behalf. Let the little square boxes (which in some countries the law obliges people to hang out of doors for starlings) be imitated, and care taken that the young are out of all danger of being carried off. And when the thrush, the chaffinch, and others make nests on a tree, let them be protected from children and cats by surrounding the trunk with a crown of thorns. To compensate the want of hollow trees for those birds which choose holes to hatch in, it is easy to make small boxes of common wood, closed on three sides, but having on the fourth a small opening left, and place beside them a round piece of wood to serve as a perch; such a little house should be placed facing eastward, under the cornice of a roof, or in the branches of some tree at a height of from 10 to 12 feet from the ground, not too much under the shade of the leaves, and in a retired spot. These hatching-boxes can be made of different sizes; the titmouse is very fond of a box of about 8 or 10 inches in length inside, and of 3 or 4 inches in height: of course larger birds prefer roomier berths. These boxes should be painted of a dark-grey colour, and well garnished with moss. Much good has been done in this way, now that the importance of encouraging bird-hatching is more generally appreciated in zoological gardens, agricultural schools, and horticultural establishments. Under the advice of men of science and of judicious landholders, many thousands of hatching-boxes are being set up, and no outlay is more quickly remunerative. Whoever possesses a suitable piece of ground may give himself a real treat, and at the same time much gratify the winged gentry, by planting a small space thickly with thorn-bushes, cherry-trees, oaks, firs, &c., and covering the ground with branches of the prickly thorn so as to prevent the intrusion of cats. Once established, the plantation will soon be the assembly-ground of multitudes of small birds; they are very fond of such thickets, because of the sense of security they impart, and the influence of their vicinity will soon be noticeable. Many of these asylums have been such protection to large properties that fruit has ripened even in unfavourable seasons. During both winter and summer the

grateful birds had been hard at work, and cleansed every tree from insects. Those who cannot form such thickets can at all events place just off the roofs of their houses or barns, a rather broad lath, on which swallows will love to perch. More may be done for our own gratification as well as that of birds, by placing a board, with a covering and side pieces attached to it to keep off snow or rain, out of the window of an uninhabited room, or in some out-of-the-way corner; let it be kept plentifully supplied with crumbs of bread, little bits of potato, barley seeds, and elderberries, and the hostelry will be in very great request, especially during the winter season, and it will be gladdening to witness the mirth and good humour existing amongst the little visitors. Such a thing is easily arranged, and is of real benefit to the half-starved bird, which soon gets accustomed to the hospitable house, and pays its debt of gratitude during summer-time by loud songs and a zealous hunt after insects.

To fix the useful titmouse in one particular spot, these simple means are employed. A caged titmouse is placed on the branches of a tree, and the captive will soon attract its companions. If a few green fir-branches be hung during the autumn on the bare boughs of fruit-trees, they will during the winter be actively visited and regularly cleansed by the titmouse. It is well to come to the rescue of small birds, especially during the hatching season, and deliver them from their winged enemies, magpies (*Corvus pica*), ravens (*Corvus corax*), &c.; whilst for the protection of fish-ponds, we must wage war against the common heron (*Ardea cinerea*), and the water-ouzel (*Anclus aquaticus*); but the capture and sale of the titmouse, the chaffinch, the redbreast, ought to be strictly prohibited, and the indiscriminate slaughter of insectivorous birds heartily condemned.

Reader, take the work of preservation to heart! You have looked into the admirable economy of Nature which God has so wisely ordained and organised, manifesting His power even amidst the most minute objects. Contribute to the utmost of your power to maintain that order: it is both pious and wise to do so!

Feed and protect these birds: they will enliven your courtyards and gardens; they will come to you in full confidence, and await the crumbs given by your hands; they will build nests in your bushes and amuse you by their activity and solicitude for their young; they will charm your ears with their songs of joy and gratitude; and if throughout the land they find both protection and comfort, they will largely and in a most striking manner requite the benefits received by proving themselves to be the most faithful protectors of your fields and forests, orchards and gardens, and of cultivation in general.

XIV.—*On the Management of a Home Farm.* By T. Bowick.

Prize Essay.

Home, park, or demesne farms, vary in character, extent, and in the objects which they seek to attain, but they have, generally speaking, certain common features which distinguish them from those leased to a tenant. The ducal establishment, with its couple of thousand acres of pasture and arable, its flocks and its herds and its highly finished homestead, and the few acres of lawn or pasture which the retired tradesman has attached to his villa for the supply of rich Alderney milk, have the same leading object—viz., personal accommodation: an end too often purchased at a high rate, although instances are numerous, and on the increase, in which commercial considerations are thoroughly satisfied; while the fair *prestige* and example "how they do things at the Hall" is thoroughly kept up. In such cases a valuer's rent is placed on the acres in hand, and a strict unvarnished account shows what is really doing in each department. Some of these home farms have proved of great use to the agricultural world. Who can tell how much agriculture owes to the stimulus imparted in former days by the Woburn or Holkham gatherings? Have not Tortworth, Althorp, and other places done much for the Shorthorn, Goodwood for the Southdown, and Kinnaird Castle for the excellent Polled Angus? Other cases there have no doubt been, where, from careless management and untidiness, or from the opposite extreme of lavish and improvident expenditure, "his Lordship's farming" has only proved a by-word and an example to be avoided.

In these notes we shall not refer either to the one extreme or the other of this wide subject. Our remarks must first be directed to—

1. The Buildings and Appurtenances.

These will, of course, be in proportion to the extent of the occupation. Park farms, at least in England, have usually a large breadth of grass-land attached, and the quantity of arable is often proportionately small. Hence the range of premises is naturally not so extensive as where roots and corn more abound. Model homesteads, &c., although to be met with in most counties, are not essential to the system. They are all very well in their way; but if everything be not up to the same mark, if repairs be in arrear, or the stock inferior, there is a sense of incongruity which mars the effect. Besides which, if the private homestead be on a magnificent scale, whilst elsewhere there are still signs of neglect, the tenants on the property cannot but be unfavourably

impressed by the contrast. Rather let the estate bear a quiet and unassuming aspect, its buildings being plain but sufficient, showing that repairs and alterations are promptly and judiciously executed, from the farm in hand down to the humblest outlying tenement.

If the home premises are to be remodelled and a new site selected, a spot about a quarter of a mile distant from the mansion should be chosen. If more remote, the supply of provisions to the house will be inconvenient, and the afternoon stroll of visitors to the farm an effort; if nearer, the farm-traffic will invade the privacy of the walks and drives. But, wherever be the site, neatness and order should alike prevail, nor will a little extra labour expended to that end be money thrown away; houses and sheds will be all the sweeter, as well as look better, for being whitewashed inside two or three times a year.

A messroom for the hands is indispensable; and let it be a snug, comfortable place, where men may meet sociably at meal-times, and thus compensate, as far as possible, for the long walk home which most of them are obliged to take, since the nearest village may be considerably beyond the park bounds. Plenty of fuel should be supplied, a boiler and oven available, with plain table and forms to complete the furniture; and a woman should be appointed to give the room a thorough weekly cleansing. The addition of a few books and an occasional newspaper will be found an acceptable boon. A farm office, for the manager, must not be forgotten. It is not well that he should have to transact the bulk of his business in his own house, or to pay the men in his kitchen, or to bring every stranger into his parlour whose business demands the use of pen and ink. The cost of a farm-office well fitted up is generally a good investment: there the hands are paid, and there the simple instruments for surveying—a tape, chain, cross-staff, and draining-level—will be deposited, together with maps, plans, and farm accounts, as well as any agricultural literature which the owner may think well to supply.

To complete the furniture of this room, it is desirable that some such medicine-chest should be provided as was made, from a design sent by the writer, by Messrs. Burgess and Key, of London. Although we should not advise either the farmer or the home-farm manager to become his own veterinary surgeon in the more serious class of cases, it is, nevertheless, desirable to have a well-arranged selection of *compounded* remedies at hand in case of emergency; and no properly qualified professional man will view this practice with feelings of jealousy. Indeed, our supply of prepared medicines is furnished by the gentleman who has attended the horses on this farm for over thirty years.

The upper portion of this chest is protected by folding-doors,

fastened by lock and key. On opening the doors the upper portion is found to be divided vertically into three compartments, each containing five drawers. The right-hand division is reserved for the service of the stable, beginning with the lighter ailments, and ending with gripe or colic, which is one of the most serious or annoying of common complaints. On the left we have a series of drawers devoted to the cow stock, both for external and internal use. In the centre is Bagshaw and Harris's excellent foot-halt ointment for sheep, two reserve drawers, vermin poison, and dressing for seed-corn. Below is a large drawer, stretching across the full width, devoted to Read's instruments; it also contains the box with numbers for branding the herd. The above are all lockfast, but there are a couple of deep drawers below, which are not locked. These contain "twine, cord, and bandages;" and "tacks, nails, hammers, &c.," respectively. Weights and scales are kept, though little used. We are far from advocating the home compounding of medicines; leave that matter to the clever chemist behind the counter. It is not well when illness occurs to have to run to Clater or Youatt, and then to begin compounding, or else to send to the nearest druggist. A good selection, kept and arranged in the manner indicated, will, in the majority of years, and with the majority of intelligent men, be constantly in requisition, and prove a most desirable adjunct to the fittings of the farm office.

As the proprietor will generally wish to be able to show choice stock of some kind, a pure-bred bull, a Clydesdale stallion, fine milch cows, pigs, or poultry, special buildings suited to these animals will be wanted. Nor must the implement-shed be of narrow dimensions, if a judicious selection of prize implements is to be tested and introduced into the neighbourhood.

2. Arrangements for the Dairy and Stables.

Whatever doubt there may be whether such a market as London affords may not equal or even surpass the best home supplies of meat and poultry, for dairy produce few will hesitate to give the preference to the home farm. It is, however, very differently circumstanced from the common dairy farm in respect of these supplies, because milk being wanted all the year round, the cows cannot be simultaneously "dry," and ready to make a fresh start in the ensuing cheesemaking season. Nay, more, the very time when the farmer's dairy is generally at a low ebb is exactly that at which "the house" calls for its amplest supply. When country amusements are most rife, and country houses best filled, a succession of cows must be provided to meet the emergency. It is no use for the bailiff to grumble, or for the agent or auditor

to say that the accounts should be kept down. Calf-rearing must for the time be sacrificed, and the most liberal cow-feeding practised. If the home farm is not equal to such a call as this, if a risk be then run of having to purchase rancid cream or turnip-flavoured milk or butter, of what real use is it? Where thirty cows are kept, an arrangement by which half-a-dozen young heifers should annually come in between November and February, in addition to the other cows, would generally meet the case. This is better policy than to be forced into the market when milking-cows are both scarce and dear. The aged cows can be drafted off at convenience.

In some cases, dairy matters are wholly managed at the farm: butter, cheese, milk, and cream being simply supplied as required. In others—and this arrangement we think the best—the milk alone is supplied immediately after each meal, the quantity gauged, entered at a stated figure, and the dairymaid (who belongs to the indoor establishment) is then responsible for results. The dairy under such a system is equally a part of "the hall" with the laundry or the bakehouse, and at least as interesting and as sightly as either.

If taken at once to the mansion-house dairy, as suggested, the whey will be brought back to the farm for the pigs in the kitchen-refuse cart or "wash-waggon" every morning. Any skim-milk, on the other hand, will either be returned to the farm for calf-rearing purposes, or else be supplied to the poorer cottagers around, who attend regularly for the kitchen soup and broken victuals.*

The most convenient mode of promptly and safely conveying the milk to the dairy will be by a hand milk-waggon, of which the sketch in page 251 (designed by the writer and in regular employment) shows a very useful form.

The tub is moveable; it swings freely on its axles, no commotion is added to the contents, and thirty or forty gallons are readily enough managed by the milkman. A gauging-rod, carefully graduated, at once shows the quantity to a quart—the lowest division that it is worth while to go to. As to the price at which the supply should be entered, local circumstances ought to be taken into consideration; but, generally speaking,

* I do not agree to this view. If the farm be within a quarter of a mile of the hall, the dairy, &c., will be better there; the spare milk for calves, whey for pigs, surplus butter for market are all on the spot, and there is no waste in the transmission. The production of the raw material and its manufacture can be carried on together, and the consumer is within a reasonable distance from the supply. The one course makes the farm responsible for the economical conversion of the whole supply of produce, be it more or less; the other transfers this responsibility to the mansion. There can be no doubt which will lead to the best *economical* result.—J. D. D.

8*d.* or 9*d.* per gallon will not be unfair towards the farm, nor unduly high for affording favourable results from its after-management at the dairy.*

MILK VESSEL. (A—Seat for spare bucket.)

The quality of the milk, as Professor Voelcker's lecture well shows, is influenced by many different causes connected both with the treatment of the animals and the kind and quality of the food given. An extravagant supply of oilcake, as shown in Mr. Barthrop's case, may only yield an unchurnable article; while if the animals are stinted in food they give not only little milk, but also of poorer quality. According to theory, it would appear that food rich in oily or fatty matter would be extremely useful for producing rich milk; but in practice we often see a different result, an increase of fat and flesh taking place at the cost of the milk; whilst the very richest and finest-flavoured milk can be produced with certainty by the use of home-grown food only. Good meadow-hay (not over-heated) and carrots, with the addition of bean-meal, crushed oats, or bran, constitute the only viands employed. By the end of March or beginning of April we venture to substitute mangolds for the carrots, but not at an earlier date, or the flavour would be complained of. The roots are given washed, sliced, and mixed with hay-chaff. No home-farm should be without its plot of carrots, if only five or six acres in extent: they are useful for all kinds of stock, but especially for milking-cows and young animals.

* A fair price for the house to pay for its requirements, but not for the bulk of the milk.—P. H. F.

Supplies for the stable are also commonly made from the farm. These include oats and beans, hay, straw, bran, linseed; besides such services as keeping the stableyard free from weeds, and sending clay for the loose boxes when the hunting-season is over. On the principle that "the best is the cheapest," and that high speed demands the choicest quality of food, it should be borne in mind that all home-grown oats sent in must be dry, sweet, finely-coloured, and weigh well; a stock of old beans and old hay will also be kept, or suitable lots purchased. Everything supplied will be noted in the yard-books, and at the close of the week an invoice sent to the house steward or head coachman thus:—

Park Farm.

No. 30. *Week ending* 25*th April,* 1862.

The Right Hon. Lord ———

Dr. to Home Farm.

Delivered to Mr. A. B. *By* C. D.

Description.	Quantity.	Rate.	£. s. d.
Beans	6 bushels	6*s.*	1 16 0
Bran	1 sack ..	..	0 7 0
Oats	20 quarters	32*s.*	32 0 0
Hay	1 ton ..	..	5 10 0
Straw	2 tons ..	40 .	4 0 0
Linseed	1 bushel	..	0 7 0
	..	..	£44 0 0

R. S., *Farm Bailiff.*

The corresponding duplicate remaining in the cheque-book affords ready means for making out and classifying the supplies to the stables at the end of each half-year. In regard to purchased lots, say of oats or beans, the articles will go in at the market price, with a fair extra charge for carriage.

Where sufficient straw is not grown for the use of the stables, it is often the custom of the estate for each tenant to send in a given number of tons annually at a stated figure. A list of the apportionment being supplied to the bailiff, it is for him to see to the delivery of the various lots as required, and also to settle promptly for the same, the stables being indebted to the farm for the amount. In order that no dispute may arise as to the weight, it is desirable to have a weighing-machine, on which the loaded waggons may be placed; for if the boltens have to be counted, and the average weight then computed, the chances are that misunderstandings will sooner or later happen. The litter from the stables is often retained for the service of the gardens; though

a large portion of it—especially the shorter litter and the droppings—may be essential, it does seem wasteful that long litter, often but little tainted, should find its way to the compost-heap in the back regions of the gardens, there to be destroyed by slow combustion. For the littering of a common open farmyard, such material is all that can be desired. Reformation is needed in this respect.*

3. Other Farm-Supplies.

Meat, poultry, eggs, potatoes, peas for kitchen use, and sundry other items, may be included under the above heading. It is now so difficult to obtain light weights and small joints, that a stock of Southdowns must be kept, or purchases made in summer from the droves of Welsh sheep and half-breds going up the country. The latter are grazed in the deer-park, with but little care or attention for the next twelve months, and should then be fit for drafting into superior pasturage. When killed, the half-bred Welsh may weigh from 11 lbs. to 15 lbs. per quarter, and the Welsh about 10 lbs., if they have done fairly; therefore, if the former were bought in at 28*s.* each, and the latter at 17*s.*, it is evident that they have not paid much for their keep, which, however, during a whole year will have been almost restricted to grass. Provision must be made in the farm-flock for a supply of early lamb, either house-fed or otherwise, and this should be ready to replace the killing of small pork in March, at latest.

As regards beef, any of our pure breeds, well-fed and of sufficient age, will generally be acceptable; but the preference is undoubtedly due to the West Highlander, of which a sufficient stock for the year's requirements is laid in towards autumn. Of late years, these, as well as other breeds, have been coming earlier to the shambles; so that, unless kept two or three years on purpose, a six-year old bullock can hardly now be met with. About 80 Smithfield stones—a very suitable killing weight—can be reached long before that age, if wished; but, by rightly selecting the stock, the object of killing at a ripe age may be obtained with fair success. For the sake of choice, the bailiff should be allowed to attend one of the Falkirk trysts, for the cost of the journey will be as surely repaid in his case as in that of the dealer who picks up the refuse of the fair and brings them south on commission. This is a point on which many mistakes are made.

In feeding pigs, both for bacon and pork, the food used should be of the choicest sorts only. Barley-meal alone we do not find

* The heating process is often turned to account in the garden; partial restoration to the farm would confuse the accounts.—P. H. F.

to make such well-flavoured bacon as when mixed with oatmeal or finely-crushed oats. A weekly invoice will also be made up from the slaughterhouse-book, and sent to the cook, the duplicate being retained for making up the half-yearly returns.

Park Farm.

No. 30. *Week ending* 25*th April,* 1862.

The Right Hon. Lord ———

DR. TO HOME FARM.

Delivered to E. F. *By* G. H.

Description.	Lbs.	Rate.	
		d.	£. s. d.
1 Sheep	72		
1 ,, Welsh	41		
1 ,, ...	80		
1 ,, Half-bred	53		
1 ,, ...	68		
1 ,, Welsh	37		
1 ,, ...	76		
	427		
Beef	313		
Pork	64		
	804	7½ *	25 2 6

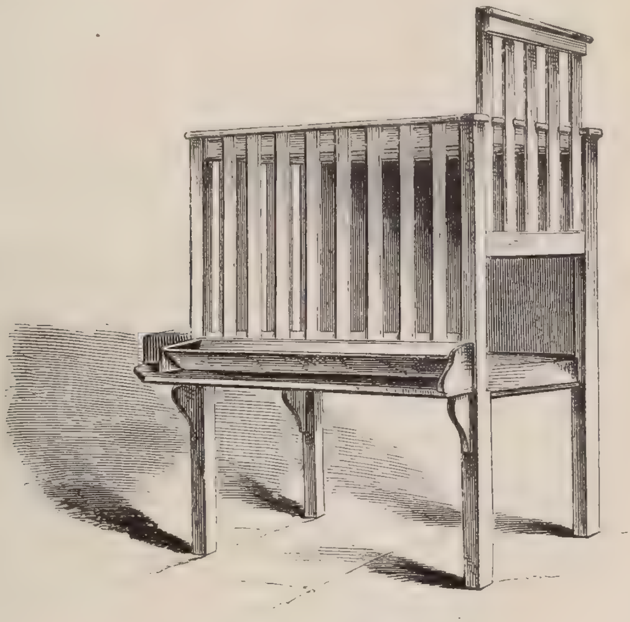
R. S., *Farm Bailiff.*

The shepherd, with his assistant, ought to manage the killing department in addition to other duties.

Among the remaining supplies, poultry must not be forgotten, the more especially as the question of quality often forms a sore point of dissatisfaction and complaint. There is no denying the fact that fowls—young and good, it may be—which have the run of the farmyard, are not equal, on the spit or at table, to coop-fed or forced birds; and without a regular poultry-woman, a liberal outlay, and fair accommodation, the supply cannot be judiciously managed. No average farm can be expected from its own breeding to send in a full supply throughout the year, unless there are breeding-yards and other appointments to match. Where this is not the case, the better plan is to purchase as many good young birds—avoiding cocks—in the neighbourhood, as possible. Get them in succession, just at the period when they would be sent to the local markets; then put them up in close coops, a dozen at a time, and in ten days, with judicious feeding, they will come out nice plump birds, with delicate white flesh.

* Only one rate per lb. is here entered; but this requires to be varied according to market value.

The food should consist of Scotch oatmeal, made into dough with milk, and with a supply of milk only to drink. Before another lot of fowls are put up, the coop should be thoroughly cleansed, scoured, and purified with a solution of chloride of lime. It is well, however, to keep a good breeding stock of fowls for the purpose of supplying fresh eggs all the year round, selecting a good breed or breeds, and keeping them pure for the sake of taste and appearance.



Poultry-Coop, on Baily's plan.

No better eggs can be had than those yielded by the various classes of Hamburghs. They are small, but well-flavoured and abundant; they should be gathered every morning, and delivered over to the care of the housekeeper or cook at once, as a guarantee for their freshness. They are entered in the yard-book, and charged at per score or per hundred, half-yearly, in the gross. But as the Hamburghs can hardly be depended upon for rearing chickens, another plan must be adopted for the renewal of stock-birds. This can easily be managed by hatching with mongrel hens at another yard or homestead; or, if that is not practicable, then arrangements may be made with any cottagers who are in the habit of rearing poultry for sale. Supply the eggs and chicken-food, and take the birds at 3*d.*, 4*d.*, or 6*d.* each, at the time they are able to

leave the hen. By this means, for a small outlay, plenty of rearing fowls can be had, and it will answer the cottager's purpose full as well as rearing on their own behalf. In order to keep up and improve a pure breed, it is desirable to select, early in January, one cock and three hens, the best you can find, and place them in a separate walk: sufficient eggs for breeding purposes will thus be readily obtained.

The supply of potatoes remains to be considered. These will probably be furnished from the gardens up to the beginning of October, and from that date till the next May field-grown produce will be in demand. Grow the very choicest kinds—Flukes or Regents—in land not over-stimulated with manure, and store them only when come to full maturity. Let all the smaller and second-rate sizes be sorted and disposed of at once, or kept for sale as seed in spring, that the amount sold may replace the outlay for a good change of seed. The best lots will be sent in, one or two sacks at a time, as required.

We have spoken about not over-stimulating the potato crop. On this point a very successful manager of a home farm writes us that the only manure he has used for several years is the coal-ashes from the Castle, by which means crops of the choicest quality, free from disease, have been obtained.

Other departments of the establishment, as well as the house itself, require services from the farm of one kind or another. The errand-horse is sometimes entered in the coach-stable's account, sometimes as a separate entry. The forester needs horse-labour, and possibly the keep of a riding-horse, both of which come from the farm. The former will either be charged at a given rate per day, or the average cost in a series of years taken and entered in one sum. This is the better plan where a team is not entirely reserved, as it does away with a multitude of entries, and will work well where there is any degree of harmony or co-operation. But if the team should be employed in timber-haulage and such-like work most of the year, it is best that it should be wholly under the forester's control, and a charge for keep simply be made. The same remark holds good both with estate-haulages for buildings and for garden purposes. A divided responsibility, the limits of which cannot readily be defined, leaves the hands too much without supervision, for the work to be satisfactorily done.

The gamekeeper will call for barley, wheat, or Indian corn for pheasants, and possibly carrots during winter for hares. The park-keeper, too, has his varied wants—hay to be stacked in summer, of the finest and shortest growth; swedes and beans in winter, to bring the herd well out in spring. And lastly, a jobbing-cart and "a general purpose man," of active habits, is

a desirable addition to the farm-staff. If the ashpit requires emptying, if the stores of faggots or charcoal need replenishing, if heavy luggage has to be taken to or to come from the railway-station, or a hundred other incidental wants arise, the "jobbing-cart" will come in as an essential addition.

We now turn to consider—

4. THE ADVANTAGES AND DRAWBACKS OF SUCH A CONNECTION.

From what has been said under the preceding heads, but little room is left for remark here. Sir John Sinclair, writing half a century ago, says: "It is not only a healthy but a useful employment for gentlemen residing in the country to have some land in their own possession for the purpose of accommodation or amusement, and to provide themselves with the various articles which their families may require. Perhaps these articles might often be purchased fully as cheap at market, and it might be more profitable to the proprietors to let the land at a fair rent; but it would be highly unpleasant for any gentleman to have the servants of another over whom he could have no control working constantly near his own house, and to have scarcely a spot he could call his own on which he or his family could take air or exercise. What the extent of such farms should be it is not necessary to discuss, as so much depends upon the establishment kept by the proprietor, the time he resides in the country, and the degree of attention which he can give to his farm." *

The supply of home-grown produce ensures, or at least ought to ensure, first-rate quality and perfect freshness. And if occasionally loss should arise, from having too heavy a stock—of dead meat, for instance—on hand, such an event need but rarely occur. Neighbouring butchers will readily purchase any surplus at a fair rate, or supply an occasional deficiency. If stock be sometimes held for home consumption to a period beyond that at which it could be profitably disposed of, and if meat or other supplies be sent in at such a price as will not clear the farm for its outlay, such mistakes are rare, and may be avoided. If the coal-haulage for hall, gardens, and stables is performed by the farm, a convenient season may be chosen, so as neither to let the roads be cut up with heavy haulage in a wet time, nor interrupt the regularity of the supply. Where there is an arrangement for the performance of this labour by the tenants, such drawbacks are not infrequent.

5. MANAGEMENT OF PARKS, ROADS, AND DRIVES.

The quantity of grass-land which surrounds the larger country-

* 'An Account of the Systems of Husbandry adopted in the more Improved Districts of Scotland.' Edinburgh, 1813.

seats is a feature peculiar to this country. Although corn-fields look well when harvest draws nigh, and tillage-operations are interesting to all persons of rural tastes, still the park, with its woodland, water, stately timber-trees, and spreading lawns, is unrivalled in perennial grandeur. Hence the landowner is more often bent on adding to the breadth of pasturage within view of the mansion than on breaking it up, and the home farm often contains six or eight times as many acres of grass as of arable land.

The greater, then, the extent of permanent pasture, the greater the importance of its being well and creditably kept. Where there is a strong head of deer, the park is allowed to retain more uncultivated features, so that they may enjoy the fern and rank vegetation of their natural lair. This looks well through the summer months, but in autumn, winter, and spring, its aspect is often bleak and uninviting. Better far that the home-park and the deer-park be kept distinct, and under different treatment. The former will then assume a better aspect—it will be mown annually, close-grazed in autumn, never trodden or stalked in wet weather, and receive ample stimulating doses of artificial or farmyard manure. In spring the chain-harrow and clod-crusher will be in active operation. When moles or rabbits show themselves, extermination will be the order of the day; where a want of drainage is indicated, the want will be at once supplied, while a general aspect of neatness should pervade the whole. The best season for applying well-made yard-dung to the park is immediately upon the removal of the haycrop; a far neater and greener aspect is thus obtained than by any other means. After a day or two of the July rains the dressing will hardly be visible, though its effects will tell for two years to come. The manure will be all the more valuable for the purpose, if a few hundredweights per acre of bonedust have been added to the compost-heap while in course of preparation; and this suggests the hint that all bones produced on the place, in the house, farm, or dog-kennels, should be carefully preserved and sent to the bonemill for application to the land. In many places the supply thus obtained will be worth from 10*l.* to 30*l.*, or even 40*l.* per annum.

Rural fêtes, such as hunt-meetings, volunteer-gatherings, and yeomanry-exercisings, entail on their public-spirited patrons expenses for preparing and reinstating the park, of which the public perhaps hardly appreciate the full extent. Besides clearing away litter, heavy rollings to erase the track-marks of carriages and horses on the soft ground, and fresh grass-seeds, if not new turf, will often be required. The sooner these points are attended to the better. In turning out animals to graze in the park, care must be taken to exclude such as have exhibited any

sign of vice. Young horses and West Highland oxen will generally be transferred to a run in the deer-park.

Although the cost of maintaining roads, walks, and drives, is entered in a separate book, yet the work may be advantageously executed under the supervision of the farm-manager by men and horses under his charge. Both the haulage and the hand-labour required for this class of work are slack at the busy time of the agricultural year. Thus all road-repairs should be done in the early part of winter, at least as far as the putting on of materials is concerned. In autumn there is the needful cleansing from leaves, ruts, and standing water, though the two latter should never have to be named when once the roads are got into good order. In spring, edging and cleansing have to be attended to; weeding follows as a matter of course; and then, where haywork is pressing, or roots require the hoe, all the hands are available for the farm. Edging should rarely be done oftener than twice a-year, and the very best hand to be got—a man with a good eye and a fair amount of taste—must be selected; but unfortunately the system too often is to send worn-out men, or semi-pensioners, to the job. Now, it is very pleasant to see old and faithful service kindly recognised by the owners of property, and a light job, with full pay, is probably the easiest mode of dealing with it; but at the same time the services of such men, bringing neither skill, experience, nor energy to the task, are probably about as costly a mode of keeping up roads and drives as could well be devised. By all means let the sweeping up, cleansing, collecting leaves, &c., be left to them, but do not place a pick or an edging-tool into such hands.

For the destruction of weeds, an application of dry salt is the most efficient and readiest mode yet devised. A ton will do both sides of a drive a mile in length, and if applied in May, when the weather is dry, so that it has time to exert its full strength, little more attention to weeding will be required till the August or September following. A half-dressing, in those places only where the weeds have started, will then keep them snug for the winter. This is quite as efficient a plan and much less troublesome than the more highly-finished mode of scalding with brine, from a Trentham engine. In either case there is a great advantage as compared with hand-weeding; the road is not slackened, as with the hoe, but its consolidation and firmness is rather increased. The only point to be observed in sowing dry salt is to see that the adjacent herbage is not scorched. We have met this difficulty by sending alongside of the man who is sowing a boy, who drags a board, 12 feet long and about 18 inches deep, held in a perpendicular, or rather an oblique position. The same practice of applying dry salt is equally useful for stable-yards and paved courts. All drives

should be kept free from loose stones, the perfection of a road being its smooth and not over convex surface.

The golden rule in regard to roads must ever be "keep clear of ruts." This is not only a sure test of a well-kept road, public or private, but also a maxim to be enforced on drivers, who should be required to drive *out of the tracks.* A little firmness and perseverance may be needed to get this rule observed; but the thing has been done, and can be done again. It is desirable that the roads outside the park-walls, as well as within, should show a considerable amount of care, "as if they belonged to some one." This can be best accomplished by the owner taking the keeping of so many miles of the adjacent roads into his own hands, in return for which the parish releases him from contributing to the other roads maintained by the rates. Such an arrangement would often obviate much heart-burning, jealousy, and complaint.

6. Farm Accounts.

These are often, on such establishments, unnecessarily complicated and extensive. The separate field system and distinct profit-and-loss account for every description of stock, live or dead, with days and half-days of horse and manual labour, charged under the various heads, however desirable in theory, are rarely satisfactory in practice. A merchant may readily enough have a correct sugar or broadcloth account, because he can reckon his purchases, sales, and residue of these goods distinct from the rest of his stock-in-trade; but a farm must be viewed as a whole, because one part is not only generally essential to the rest, but the profit on one entry often includes dealings with several other parts of that whole. We respectfully submit that the object of keeping accounts ought to be to impart clearness and precision—not to complicate, still less to mystify, the system of management adopted. Yet on the home-farm an accurate and intelligible system of accounts is essential. Even if the proprietor has but little leisure or taste for looking into the practical part, he will still like to know exactly how matters are proceeding; the auditor and agent will both require a strict account of money matters, while a good and *bonâ fide* balance-sheet at the year's end is what every good manager will delight to see.

The first point will be rightly to distinguish and separate the labour and expenses and receipts which belong essentially to the farm from that part which does not. The latter expenses may be entered in a "weekly account current" betwixt the principal and the manager. This will include all road-labour and expenses, the hands usually employed at estate and timber haulage and with the jobbing-cart, any blacksmiths or mechanics at work under the bailiff's directions, and also any pensions and gratuities. Such account would stand thus:—

R. S. [BAILIFF] IN ACCOUNT WITH THE RIGHT HON. LORD ———.

1862.	RECEIPTS.				£.	s.	d.
25 Apr.	Forward from fol. 29				8	2	4
	Cheque from M. N., Esq. [Agent], No. 362 ..				45	0	0
					53	2	4
	PAYMENTS.	£.	s.	d.			
25 Apr.	Labour, as per opposite	14	0	8			
	Taylor, J., Salt for Roads, voucher 42	8	9	3			
	Ludlow, W., Damages getting Gravel, voucher 43	3	5	6			
					25	15	5
	Forward to fol. 31				27	6	11

Date.	Names.	Employment.	Time.	Rate.				
1862.			Days.	s.	d.	£.	s.	d.
25 Apr.	Hudson, W. ..	Timber Haulage ..	6	3	0	0	18	0
	Ellis, G.	Ditto	6	2	0	0	12	0
	Rowley, H. ..	Estate Haulages ..	6	3	0	0	18	0
	Musgrove, J. ..	Jobbing-cart	6	2	6	0	15	0
	Grant, Jos. ..	Road-work	6	2	0	0	12	0
	Parker, Job ..	Ditto	4	2	0	0	8	0
	Harrison, W. ..	Sweeping Drives ..	6	2	0	0	12	0
	Cash, J.	Ditto	5	2	0	0	10	0
	Freeman, T. ..	Road-edging	6	2	8	0	16	0
	Harper, Geo. ..	Sowing Salt	6	2	4	0	14	0
	Wilson, Rd. ..	Road-work	6	2	2	0	13	0
	Wheeler, Rd. ..	Clearing Roadside Drains	5	2	4	0	11	8
	Lambert, J. ..	With Keepers ..	6	2	6	0	15	0
						8	14	8
	Bach, W. ..	Shoeing and Jobbing Smith	4	5	0	1	0	0
	Barker, J. ..	Ditto	6	3	6	1	1	0
	Williams & Co.	Advanced on Gravel-getting	..	..		3	5	0
						14	0	8

According as the payments progress, so must the receipts be replenished by the cheques of principal or agent.

This disposes in a summary, yet legitimate manner, of those entries which have, properly speaking, no claim upon the farm. Then on the farm itself you require a labour-book, containing the usual details, and the cash-account, which is copied weekly from the waste-book or payable-sheet. In our case the general employment alone is entered, the benefit of having separate columns for every day of the week being doubtful. The Farm Account-book is 17 inches by 10½ inches, and has the various details of one week at a single opening. The left-hand page states first the names, employment, and weekly wages of day-labourers, next the names and earnings of those at work by the piece. On the right an account of the live-stock is given in detail, giving totals at beginning and end of week, with a separate column for births, deaths, sales, purchases, and meat killed. A similar account for grain winnowed, bought, sold, consumed, and sown, follows; next comes a space for memoranda, where the chief incidents of the week are recorded, *e. g.*, "April 22nd and 23rd. Drilled 18 acres of orange-globe mangold, on field number 7, on the flat; 27 inches wide; 5 lbs. of seed" per acre. A weather-table, recording the temperature, direction of wind, and character of each day, completes the weekly account. These reports are made up weekly, fortnightly, or monthly, according to the arrangements of the establishment—the former being the best where weekly wages prevail. The stock "bred" will be entered from the yardman's book: "bought" and "sold" should correspond with the cash-account; while the slaughterhouse-book and the invoice to cook will exhibit the numbers killed. In like manner the yard-books show the corn in granary and the quantities bought, sold, consumed, or sown. "Memoranda" will, of course, include some of the many facts, dates, or quantities, which all farmers find it worth while to notice. This system of entries, which is neither complicated nor tedious, can be recommended, after a comparison with those of various home-farms, as the best adapted for general purposes. Even for the tenant-farmer, who cares for a full yet simple detail of his current management, we question if any better can be offered.

The cash-department is kept in another part towards the end of the volume, 20 or 30 specially ruled folios being retained for the purpose; thus—

[Previous Week.]

1862.	30th week, ending 25 April, 1862:—	£.	s.	d.	1862.	Voucher.	30th week, ending 25 April, 1862:—	£.	s.	d.
19 April	To balance from last week	68	18	10	22 April	164	By Lawson and Son, Phospho-Peruvian Guano	55	11	0
23 ,,	,, Wilson and Co., 68 qrs. Wheat, at 62*s.*	210	16	0		165	,, Barker, Indian Corn for Game ..	21	9	0
25 ,,	,, Mursell, W., 2 three-year old Steers ..	56	0	0	25 ,,	166	,, Royal Insurance Company, "Stock and Buildings"	10	10	0
25 ,,	,, Roberts, J., 20 surplus Welsh Sheep, at 28*s.*	28	0	0		167	,, Wilson and Co., Bran for Stables	12	13	0
							,, Labour, as per fol. 30	18	17	10
							,, Balance to next week	244	14	0
		363	14	10				363	14	10

[Next Week.]

Here it will be observed that nothing more is presented than the receipts and payments respectively, and the balance forward either to or by the credit of the bailiff. The cash is replenished from two sources—either from receipts for sales of produce, or from cheques, as required, whether drawn by the proprietor or his agent. For these the bailiff gives a receipt, and then the farm-book shows how the various sums are disposed of. Thus the farm takes credit for cash advanced, and gives credit for the supplies sent to the other departments of the indoor or outdoor establishment until the account is balanced at the end of the half-year. An annual balance-sheet is very readily and correctly made from such details as the cash-book thus affords.

An inventory and valuation are of course taken, and the difference in the year's stock entered either on the credit or debit side. Then take the gross annual receipts, deducting cheques received from the principal or agent, and also deficiencies forward (if any). Take the gross payments for the year, and deduct the weekly balances forward, as well as the credit-entries of half-yearly supplies to house. The result, if there are no other disturbing influences, should show fairly how the concern actually stands.

Another method, though not so desirable, unless the landlord be non-resident, is to start the home-farm with a certain capital, for which a fair interest is charged. The farm then pays a sufficient rent, and all services or articles supplied are paid for in cash.

A separate book will be kept and made up half-yearly, containing the details of all farm supplies to house. But this account can be greatly shortened and simplified by using the weekly invoices we have already referred to. For instance, the full detail of meat, as given at page 254, need only appear in the "Supplies' Book" thus—

			lbs.
No. 30, April 25,	7 Sheep	..	427
„	Beef	..	313
„	1 Pig ..	..	64
			804 at 7½*d.*, 25*l.* 2*s.* 6*d.*

In like manner, for the inspection of the principal, a concise milk account may be rendered, giving only the monthly supply in gallons.

If the cash entry only be transferred to the classified totals at the end of the volume, a glance suffices to show the value of supplies to each account.

It is superfluous to urge the desirability of keeping such books neatly and accurately, that is a point on which all are agreed;

but in order that they be thus accurately kept, they should be promptly and regularly audited. For want of this examination, how many lamentable break-downs have occurred in the agricultural world! To be lax in this respect, is neither more nor less than to lead a man into temptation: and, even if the path of rectitude is nominally retained, entries and work will be allowed to get behind, and into anything but a creditable condition. Then when the day of reckoning comes—for it will come sooner or later—the results will not be to the credit of either party: and it is hard to say which is most to blame, the lax and careless employer, or the servant on whose shoulders the blame commonly falls. What a sad case that was, which figured lately in one of the Scottish courts, where it came out in evidence that a settlement or complete statement of accounts had never been required from the local manager for some five or six years, and though it was averred that vouchers for the payments *did* exist, yet private memorandum books, unposted up for that period, were all which could be produced!

There is another serious evil to be avoided, where the moneys of the principal are so placed that they can be freely used for personal purposes (if wished) by the individual through whose hands they pass. A right arrangement of accounts and of banking business would prevent this.

It must, however, be added that accounts on such establishments should be settled promptly and regularly. All tradesmen's bills should be sent in quarterly at latest, and accounts of every other kind paid when presented. With regard to the custom prevalent in most localities, of "chap-money" as it is called in the south, or a "luck-penny" in the north, that is an item on which many misunderstandings have occurred. The easiest mode of dealing with it, is for the manager resolutely to set his face against it—to allow none, under any circumstances, and, if necessary, to let the buyers understand this before a bargain is struck. By giving no chap-money the chances of getting it are greatly diminished, but if he is able to present his accounts to his employer without vexatious and uncertain deductions of this kind, it certainly renders it much more pleasant. And if any is received, the principal will not in honour prefer a claim to the amount.

The bailiff's "Journal," from which all cash transactions are posted, will be a private book only, and should show at any given moment the amount of cash in hand. The simplest arrangement is as follows:—Supposing the week to commence on Saturday, you carry forward the cash balances (if any) from the preceding week. Then, as payments or receipts occur, deduct or add the respective amounts—the balance thus showing, as above stated, the contents of the cash-box. On the following Saturday morning, when the books are made up, it is only needful to take off

first the amounts which belong to the "weekly account," and the remainder belongs to the farm cash account. The joint balances, or difference betwixt a balance on the one and a deficiency on the other, should correspond with the balance on private account. Of course the items in said Journal will have been transferred from a pocket memorandum book, according to the order of occurrence. A herd book for detailed entries respecting the breeding stock should not be overlooked.

7. Influence of such Farms.

The influence exerted on the neighbourhood at large depends greatly upon the nature of the management pursued. In some narrow minds there is a lurking prejudice which manifests itself in this wise: "Ah, it may do very well for his Lordship, but if there were a rent to pay, things would not be done quite in *that* fashion." If such a spirit is to be deprecated, neither should frequent occasion be given for its manifestation; still, where improvements are steadily pursued, and most new plans get a trial, failures must now and then occur; but failure often reads us as useful a lesson as success can ever do. If then an open, generous spirit pervades the whole, which conceals nothing but welcomes truth in whatever garb, it may surely disregard cavilling of the sort alluded to, at an occasional mischance. If the landlord's management be not exactly a pattern for his tenantry, yet its influence may be none the less useful or desirable.

But a much more tangible influence is exerted, where a thoroughbred bull, or stallion, is kept not only for the use of the home-farm, but for the benefit of the tenantry as well. If pure-bred bull-calves are also disposed of to those on the property, at reasonable prices, material improvement in the stock may be expected. In like manner, select varieties of seed-corn, clean and true, may be disseminated with much advantage.

Great difference of opinion exists as to whether landlord and tenant should come into competition together at district agricultural associations. It is contended, on the one hand, that the former from their larger means have an unfair advantage over the other class as competitors. These objectors seem to overlook the simple fact that tenants take fully as many prizes as landlords have ever done. Rather, then, let this honourable rivalry continue.

Upon the labourers of the district, a material effect for good or evil may be produced by the manner in which such farms are conducted. If wages are higher than in the locality generally—which is often the case—there will be little difficulty in obtaining the best hands for constant employment, and if both good morals and expert workmanship be fairly recognised, a staff of men may be raised up, of whom the employer may well be proud. Oppor-

tunity is thus afforded for those who wish to better themselves in the world to do so. Referring to but the past three or four years of our own experience, in this respect, we can at this moment point to various hands now in a higher position, who availed themselves of such opportunities. One is managing a farm for a widow lady near Coventry; another is bailiff to a gentleman in Wilts; a third is foreman to a good farmer in another locality; a fourth and a fifth are in charge of lads at a reformatory institution; a sixth is assistant teacher in a district-school; two are engine drivers, one a railway porter, while nearly a dozen boys have moved to better positions. Were we allowed to suggest, we would say, *Never take on a permanent hand without obtaining a satisfactory written character, and never part with a man without furnishing him with a similar document, if he is worthy of it. Show men that character is of value in the world.* Looking further back, we may refer to another case, in which three young men were all employed at the same farm, earning at that time—for wages were low—but nine or ten shillings per week. Of these three, one has done well in the Colonies, another is resident agent to a Berkshire baronet, and the third is bailiff to a nobleman in one of the midland counties.

Good hands for drilling, ploughing, stacking, &c., with a first-class shepherd and cowman, should be found upon every home-farm. The other appointments will then match one another; the team will be well-fed and lively-going; the harness well-kept, with a spice of display about it; the stock will have an air of comfort; and the implements will be in good order, and in their proper places.

But there is one drawback in having wages higher than the current rate of the district—the difficulty of setting piecework to the hands, unless at a somewhat extravagant price. Now, piecework should of all things be cultivated, wherever practicable; it has many advantages both for employer and employed: and not the less, because slack hands (for such will get in among others) have an idea that it is not needful to work quite so hard for the squire as for other employers. It is an excellent and praiseworthy plan to let the hands off on Saturday afternoon, say at four o'clock, summer and winter. It is a boon which they will value, its loss to the employer is not appreciable, and it affords an example worthy of imitation.

Upon the owner himself a beneficial influence will assuredly be exerted, if he gives moderate attention to the farm in his own occupation. He gets a greater insight into rural affairs, he is better able to judge of all that pertains thereto, and he can more readily sympathise with the losses which his tenants at any time experience.

8. The Bailiff.

He is in Ireland designated a steward, in Scotland a grieve or overseer, while "farm manager" will either describe or designate the office all the world over. The duties and occupation attached to this position are certainly among the most pleasant which can be met with: they are not the most highly paid, probably because pleasure and profit together are more than can be often obtained. The same activity and abilities devoted to almost any other line of business would generally procure very different emoluments.

The bailiff occupies an intermediate position, between the owner and those with whom he has dealings through the farm. Hence, although retaining his individuality, it is right that he should as far as possible carry out the views and intentions of the principal. If a resident agent has the control, he in most respects represents the owner; it is, therefore, well that there should be a fair understanding at the outset. The principal or his agents have *the right* to interfere or to direct at any given time, and if the bailiff acts wisely he will give such general directions as will ensure *their* orders being attended to, though his own for the time shall remain unfulfilled. But this is a right which few honourable men care to exercise, except in an unforeseen emergency. The employer may also purchase, either personally or by commission, any stock which his taste or fancy may incline to. It makes no difference in the world to the bailiff but to lessen his responsibility; let his temper, therefore, remain unruffled. In a case which we knew some years ago, where the owner was fond of buying and selling personally, a very great mistake had been committed in the purchase of a lot of Irish animals, which, with all the feeding that could be given, had ultimately to be turned out at a sacrifice. "I told your Lordship so," said the bailiff; and a cheque for the quarter's salary was the immediate result of that morning's remark. It is no use offering one's opinion, unless such opinion is asked or expected; for we again repeat that the principal has a perfect right to take that share in the management personally which he sees fit.

Times, also, will occur when the manager is requested to be in attendance upon his employer, and that, too, at a period when business urgently claims his presence elsewhere. By all means attend the former, and make such arrangements as you best can for the latter. Country gentlemen especially, have often so many engagements on hand, that they cannot afford to wait, but must be waited upon—besides which, they pay for such attention.

The settlement of marketing and other incidental expenses often forms a source of annoyance, which had better be avoided. There have been cases where no expenses at all were charged—

where lots of beasts from distant fairs, it might be, were brought home without the slightest apparent cost to the owner. Another man enters his expenses to the minutest item, including droving charges, &c., and perhaps gets sharply criticised for his pains. Let the reader judge which plan is the right and businesslike one —viz. where expenses are fairly charged, or where expenses are left in the background, while an increase in the price per head makes all straight, and something more. In regard to weekly markets, a regular stated sum should be allowed for each attendance, fairly to cover all expenses, including dinner, stabling, and tolls. When this point is once arranged, let it be done with for all time to come.

In regard to the settlement of accounts, it is well to obtain a receipt for all moneys paid, small sums (say under half-a-sovereign) alone excepted. Though such is not the custom in farming management generally, yet it has but little difficulty in practice. The manager should be provided with blank forms of receipt, and the filling-up is only the work of a moment, while the satisfaction and clearness it affords can hardly be regarded too highly.

In relation to the other parts of the establishment, the bailiff holds an important position; as farm supplies of various kinds (labour or assistance sometimes included) bring him into connexion with most of the other heads of departments. Seek to maintain a good understanding; what supplies are wanted, let them be promptly and cheerfully given; and endeavour to keep up the credit of the establishment by honourable dealings towards all. As to the men, it is quite possible to retain a good and friendly connexion with them, while at the same time full value is obtained for the wages paid. Punctuality in hours, strict supervision, and kindly feelings, will tend materially to soften the yoke of labour. No begging for gratuities should be tolerated; and it would be better far, if that constant source of annoyance—BEER—were banished from business relations between employer and employed. But unhappily upon many a Home-farm* the tap runs too freely, part of the wages being thus paid in money and part in beer, while disputes and vexation are the invariable result. In this respect the bailiff has often in his hands a great power for good or for evil. Let such power be exerted in the right direction, and Home-farms will yet stand higher, and their utility be more acknowledged, than has hitherto been the case.

Stoneleigh Abbey Farm, Warwickshire,
April, 1862.

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* Certainly not upon all—*vide* the published experience of Mr. Holland, M.P., on this subject.

XV.—*On Portable Manures and their Home Manufacture.* By ARCHIBALD SMITH MAXWELL.

IT is unnecessary for my present object to dilate upon the benefits which agriculture has derived from the use of portable manures, because experience has already set this point beyond dispute. The next point for consideration is how the farmer, who has the knowledge of the *intrinsic* value of manures, is to guard himself against imposture in his purchases. A remedy, it was believed, would be found in the general adoption by the manure trade of the practice of selling by analysis (accompanied with a written guarantee of the bulk delivered), undoubtedly the only true test of the real value of manures. Yet notwithstanding that farmers themselves took the initiative in this matter and forced the trade to adopt this measure, how few among them take the trouble to satisfy themselves that the manures purchased are actually of the quality represented, and commercially worth the price at which they are sold! There is scarcely any district without its agricultural association or club, and surely in each a chemist is to be found at hand competent at least to detect any material depreciation in the manurial value of an article from the original analysis. If by the report upon samples submitted to such chemist for examination suspicion be at any time aroused, recourse could then be had to an accredited analytical chemist for an accurate analysis of samples taken from the bulk, which, if found to come below the standard analysis on the faith of which the purchase is made, would lead to an adjustment of the difference in value, or if the imposition be flagrant, the stuff would be returned and the result of the investigation made public. In Berwickshire this practice is in full operation, and has had a wonderful effect in checking fraud.

While the test of analysis is destructive to the interests of adulteration, it acts as a protection and encouragement to the honest dealer.

However desirable it may be that farmers should possess a general knowledge of agricultural chemistry, this is a study that demands more time and attention than most of them can well spare: it is, however, matter of surprise that so few make inquiry into the properties of the manures, which they apply in ignorance, and therefore cannot know how to use to the best advantage. An analysis is of little use merely to *look at*, to those who do not understand it or know how to calculate its worth.

In now laying before the reader the ordinary method in practice of preparing manures, I do not wish it to be imagined that the

farmer can *make* as cheaply as those extensively engaged in the trade, for quantity must always influence the cost of production; but I am of opinion that they can make at a cheaper rate than the dealers *sell*, or in other words, that the difference of the cost of production in the two cases is not equal to the profits of the trade, ranging as these do at from 15 to 25 per cent. The manufacturer may not have all this to himself: agents' commission (5 per cent.—I have known 10 per cent. and even more paid) must be provided for; *but the farmer pays for the whole.** Manures are now so numerous, and sold under so many different names, that it would fill a page to enumerate the half of them, to say nothing of many that are bought from some noted maker and again sold (at a good profit) as the buyer's *own make.* It is, however, satisfactory to observe a marked improvement in manufactured manures generally of late years, which I believe in a great measure to arise from the demand that is now made for an analysis.

Bones and their products for Manure.—The various materials from which superphosphate of lime is derived, such as bones, English or Foreign, bone-ash, animal charcoal, apatite, and coprolites, differ in value according to the proportion of bone earth which they contain. This proportion will vary from 46 per cent. in raw bones, to 50 and 60 per cent. in boiled bones or coprolites, and 60 to 80 per cent. and upwards in bone-ash, apatite, and some other foreign substances. We see, then, how wide a range is included in the value of these materials.

	Per Ton.
Assuming bone-ash containing 60 per cent., to be worth	4*l.* 5*s.*
The proportionate price for 65 per cent., would be	4*l.* 15*s.*
" " 70 " ..	5*l.* 5*s.*
" " 75 to 85 " .	6*l.* to 6*l.* 15*s.*

The value of the superphosphates is, however, estimated by the *source from whence they are derived*, as well as by the percentage of *soluble and insoluble phosphates* they yield. Superphosphates made from coprolites and apatite, although they may contain the same percentage of soluble and insoluble phosphates as from ground bones and bone-ash, do not command the same price, being of less value: hence the practice of most manufacturers is to make a distinction between the two—bone superphosphate (commonly called dissolved bones) being usually sold "warranted free of any admixture of coprolites."

It is unnecessary here to enter into the details of the machinery at present in use in a large manufactory for the preparation of superphosphates, where the object is the production of the greatest

* It is a common practice to weigh in the bags, making no allowance for tare.

quantity in the shortest time and at the smallest cost. It is enough to know that costly machinery is not required for *home manufacture*, all that is requisite being simply a *pit* or two of the following dimensions and materials, with sufficient storage accommodation.

Having dug out a space large enough for a pit 10 feet long, 6 feet wide, and 2½ feet deep, inside measurement, level the bottom and lay down 3 inches of *mill-wrought* puddle, upon which place fire-brick flue-covers to form the sole of the pit; build the sides and ends with common bricks (a brick and half thick), using *no* cement or plaster; puddle outside and pack with fine sand. After the pit has been once used for dissolving, the interstices between the bricks will be filled up. A pit of this size is capable of holding two tons of ground bones. Pits may of course be made of smaller dimensions, if preferred. Strong wooden vats or tubs will suit equally well. In preparing superphosphate, first throw into the pit the substance it is intended to dissolve; pour over this one-fourth its weight of water, stirring and mixing well with a wooden rake or pole; then add sulphuric acid, which may be twice the weight of the water or half the weight of the substance to dissolve: stir and mix the mass as before. Take, for example, 2 tons of bone-ash, containing 75 per cent. of phosphates, 10 cwt. or 112 gallons water, 1 ton sulphuric acid,* and allow to remain 48 hours in the pit: the above would yield 46 per cent. of phosphates, of which there would be 24 per cent. soluble, at an average cost of 5*l.* 5*s.* to 5*l.* 10*s.* per ton.

Superphosphate made by dissolving coprolites, apatite, or bone-ash, contains no ammonia, of which there is an appreciable quantity in superphosphate made from fresh (unboiled) bones.† Ammonia, when wanted, is generally supplied by the addition of sulphate of ammonia.

Ground bones and coprolites require more acid to make the phosphates soluble than bone-ash. The finer bones are reduced the less acid will be required, and their division being more minute, more soluble phosphates will be obtained.

When superphosphate of lime is removed from the pits, it is unnecessary to employ any drying substance to take up the redundant moisture; for if allowed to remain in a heap for a sufficient time, the moisture will evaporate by the heat generated in the mass, and although losing in weight according to the time it remains in the heap (under cover), there will be an increase in

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* Brown sulphuric acid (called unconcentrated) 1·7 specific gravity, or of 140° (by Twaddel's hydrometer), as being the cheapest, is best suited for the purpose of dissolving bones, the price ranging from 4*l.* to 4*l.* 15*s.* per ton.

† From 4 to 4·5 per cent. in unboiled bones, and from 2 to 3 in boiled bones. —P. H. F.

the percentage of soluble phosphates. If required for application shortly after preparation, care must be taken that calcareous matters (chalk or lime) are not used as drying materials, which would to a certain extent neutralise the acid, and consequently reduce the solubility of the phosphates. Dry bone-ash or bone-meal will suit the purpose well. Having thus arrived at the *basis* from which most of the best manures are made, what remains to form a *compound manure* is a very simple affair, because, as far as the farmer is concerned, according to the quantity of ammonia added, a manure will be formed rich or poor as the maker may choose. To derive the full effect from phosphoric acid, it must be conjoined with ammonia. Now, for agricultural purposes genuine Peruvian guano is the cheapest source of ammonia; therefore a mixture of pure bone superphosphate and Peruvian guano (proportioned according to the crop and soil for which it is intended), will form a phospho-Peruvian guano or manure (call it what you like) of *money value* equal to any manure sold, and infinitely superior to the greater portion of compound manures in the market. The mixture improves the power of each, the free acid of the superphosphate fixing the ammonia in the guano, which is besides presumed by some chemists to exert an influence in decomposing mineral ingredients in the soil. Should at any time a difficulty occur in procuring a supply of suitable materials for making superphosphate, then purchase genuine South American or other good phosphatic guano, of which take 3 tons and mix with 1 ton of Peruvian guano, and the result in ordinary cases, when applied to root-crops, will equal 4 tons of Peruvian *per se.* The proportions can be varied according to circumstances. Peruvian guano alone in a very dry season like 1859, proved in many places nearly a failure in comparison with this mixture, and inferior in promoting the growth of turnips to South American guano unmixed, as will be seen from the annexed published report of experiments made in 1859 on the growth of turnips with different manures by the Inverness Farmers' Society (see p. 274).

Among these nineteen carefully-selected manures, it was proved that the *same money value of South American guano* produced about 4 tons more turnips per acre than Peruvian guano, and much more in proportion than any of the other manures named and detailed in the above report—the Peruvian guano producing per imperial acre 13 tons 2 cwt. 17 lbs., at a cost of 3*s.* 9¾*d.* per ton, and the South American guano 17 tons 2 cwt. 3 qrs. 7 lbs., at a cost of 3*s.* 2¼*d.* per ton. The cost of the manures I have recommended will not exceed 8*l.* per ton, taking the price of *pure* dissolved bones and South American guano at 6*l.* 5*s.* and 6*l.* 10*s.* per ton, and Peruvian guano at 12*l.* 10*s.* per ton; and

 they

No. of Lot.	Kind of Manure Supplied.	Weight of Manure applied to each Lot.	Price per Cwt. in this District.	Extent of Land in each Lot.	Value of Manure applied to each Lot.	Rate per Acre at which each Manure was given.	Number of Drills in each Lot.	Number of Turnips in 40 yards of a Drill.	Date of Sowing.	Weight of Crop per Imperial Acre, Nov. 21, 1859.	Cost of Turnips per Ton.
		lbs.	s. d.	R. P.	£. s. d.	£. s. d.			June	tons. cwts. qrs. lbs.	s. d.
1	Seagrave's Phospho-Peruvian Guano ..	234	12 0	2 0	1 5 0	2 10 0	19	166	16	14 2 1 7	3 6½
2	Odam's Blood Manure	400	7 0	2 0	1 5 0	2 10 0	20	169	16	13 11 1 10	3 8
3	Odam's Superphosphate	464	6 0	2 0	1 5 0	2 10 0	21	171	16	13 11 1 10	3 8
4	Blaydon's Chemical Manure	386	7 3	2 0	1 5 0	2 10 0	21	171	16	14 2 1 7	3 6½
5	Robertson & Co.'s Manure	374	7 6	2 0	1 5 0	2 10 0	22	164	16	12 17 0 12	3 10½
6	Langdale's Challenge Manure	295	9 6	2 0	1 5 0	2 10 0	23	155	16	15 2 1 26	3 3½
7	Lang's Phospho-Peruvian Guano	295	9 6	2 0	1 5 0	2 10 0	24	167	16	13 17 1 3	3 7½
8	Townsend's Manure	302	9 3	2 0	1 5 0	2 10 0	24	183	16	14 7 1 12	3 5¾
9	Miller & Co.'s Superphosphate	350	8 0	2 0	1 5 0	2 10 0	24	164	16	13 7 0 22	3 8¾
10	Mackay's Permanent Manure	215	11 0	1 27	1 1 0	2 10 0	20	164	16	13 11 1 10	3 8
11	Cant & Co.'s Turnip Manure	267	10 6	2 0	1 5 0	2 10 0	24	164	16	14 17 1 21	3 4¼
12	Hill & Co.'s Manure	386	7 3	2 0	1 5 0	2 10 0	24	177	16	11 8 2 5	4 4½
13	Kooria Mooria Guano	509	5 6	2 0	1 5 0	2 10 0	24	163	16	11 6 3 12	4 4¾
14	Peruvian Guano	202	13 6	1 37	1 4 4	2 10 0	23	179	17	13 2 0 17	3 9¾
		bushels.	per bush.								
15	Bones—mixed drill and dust	8	3 3	2 3	1 6 0	2 10 0	25	175	17	8 11 1 17	5 10
		lbs.	per cwt.								
16	Concentrated Manure for Roots	220	10 6	1 23	1 0 7½	2 12 4	24	175	20	13 7 0 22	3 11
17	*South American Guano*	450	6 6	1 36	1 6 1	2 14 10	29	161	20	17 2 3 7	3 2¼
		cwt.									
18	Mixture of Manures	2	..	2 0	..	..	41	171	22	15 12 2 7	..
		loads.	per load.								
19	Farmyard Manure	6	2 0	0 38	0 12 0	2 10 0	34	203	22	11 16 3 22	4 2½

they may be applied in all seasons with greater hopes of success than nine-tenths of the *special* manures for grass, grain, and roots, with which the market is inundated.

There is another substance which farmers might turn to account for the home manufacture of manure, viz. the ammoniacal liquor from gas-works, but that in most places the entire supply is purchased by contract by the manufacturers of sulphate of ammonia. This ammoniacal liquor is of considerable value as a fermenting agent in dissolving bones. After being once distilled it contains 20 per cent. of ammonia, chiefly in the state of a carbonate, in which form it is liable to escape; and in order to check the evaporation, sulphuric acid should be mixed with it. The difficulty of procuring this liquor, as already mentioned, must interfere with its extended use on the farm. It is generally admitted that the use of nitrogenous manures alone for top-dressing cereals promotes too rapid growth, rendering the stem succulent, and thereby inducing in the crop a tendency to lodge. Many substances have been recommended to counteract this tendency, without impairing the properties of the manure employed. Salt has hitherto been most generally used, with Peruvian guano: the complaint, however, against this article is, that while it *stiffens* the straw, it *lessens* its bulk. Sulphate of soda is now coming into use to mix with nitrate of soda and sulphate of ammonia, and with good effect. As the question is asked occasionally where nitrate of soda is made, it may not be altogether out of place to state that the greater portion, if not the whole used in agriculture, is imported from South America, East Indian nitrate of soda being employed in the manufacture of nitrate of potash (saltpetre), in which state it comes to this country.

Fermented Bones.—Several substances may be employed to ferment bones: ashes of wood, peat, and coal, sawdust, droppings from the stable, brewery refuse, shoddy, or any substance that will, when mixed with ground bones, induce fermentation: these, if moistened with the drainings from the dunghill, urine, gas-liquor, &c., when reduced to a crumbling state, will furnish a manure of considerable fertilising properties. The heap having been made up with sufficient moisture, is left to ferment, the operation being performed in a covered shed. As a general rule, bones as a manure are better adapted for light gravelly soils than for stiff land.

Carcases.—Horses and cattle that die on the farm through disease, accident, or age, are in general buried; as, being of no further use, that is the best resource for putting them out of the way. I shall point out what should be done with such carcases, whereby they may be turned to some useful and economical purposes. First skin the animal, as done in a slaughterhouse;

sprinkle well the skin with salt on the fleshy side to preserve it from putrefaction, then roll it up, when it may be kept till a convenient opportunity for disposal to a tanner. The carcase is then cut up into pieces of ½ cwt., put into a boiler with water and boiled for 28 hours, by which time the flesh will have so softened that the bones can be taken out. Before doing so, whatever grease there is will float on the top; this, when skimmed off, will be found superior to any other grease for lubricating machinery and cart-axles. The boiled flesh may be cut up and mixed with the farmyard manure; and the liquor or soup might be used to ferment bones, or run into the liquid-manure tank. The quantity of each ingredient depends entirely upon the size and condition of the animals. Taking an ordinary-sized farm-horse, in working condition, weighing 15 or 16 cwt., the following may be assumed as the approximate value of the products:—

	£.	*s.*	*d.*
Skin, present value 10*s.* 6*d.*, average	0	8	6
Grease, 28 lbs., at 6*d.* per lb.	0	14	0
Bones, *dry*, 56 lbs., at 4*s.* per cwt.	0	2	0
Flesh and liquor for manure	0	2	6
	1	7	0

(84 lbs. is the greatest weight of DRY bones the *largest* horse will yield.)

We cannot too forcibly impress upon farmers the importance of being assured that the articles they purchase are genuine; the absolute necessity, therefore, of buying only by a guaranteed analysis, and of proving the correctness of the same by a check analysis of a sample taken from the bulk delivered. By this means any difference in value may be adjusted *before* application, and disputes avoided; for it is hopeless to look for redress *afterwards*, on the ground that the results did not come up to expectation. Makers of chemical manures buy the materials they use by analysis: were this precaution neglected, the manufacture of manures would be a thing of chance instead of calculation and science. Why should farmers be less alive to their own interests? The trouble is little and expense as nothing compared with the interests at stake.

There are, however, some farmers who expect too much from the use of portable manures. It is absurd to suppose that these alone can keep the land at all times in good heart; they ought rather to be employed as stimulants or auxiliaries, than as a complete substitute for farmyard manure.

27*th February*, 1861.

XVI.—*On the Commercial Value of Artificial Manures.* By Dr. Augustus Voelcker.

Not more than fifteen or twenty years ago the manufacture and sale of artificial manures partook more of the character of a venturous speculation than of that of a legitimate, well-regulated business. Few men of substance and character were then willing to embark their skill and capital in a new and untried undertaking. On the other hand, many persons thrown out of employment—having little or nothing to lose, and everything to gain—eagerly seized the opportunity of making a living by preparing and selling compounds many of which scarcely deserved the name of artificial manure. At that time inferior, altogether trashy mixtures, were the rule, and well-prepared, intrinsically valuable fertilisers quite the exception.

Like other agricultural chemists, I directed public attention to the extensive frauds to which the unsuspecting farmers of England were subjected, and was one of the first who published, with a view still further to check the nefarious dealings of unscrupulous persons, a valuation-table or priced-list of the various fertilising constituents usually entering into the composition of artificial manures.

In conjunction with chemical analysis, the valuation-tables published by Professor Way, Dr. Anderson, myself, and others, fully answered their desired end, and it was of little or no consequence to which table preference was given.

By degrees agriculturists learned to appreciate the material services which the analytical chemist was willing and capable of rendering to intending purchasers of artificial manures. The publication of these tables and their extensive use and application in estimating the money value of manures, have had much influence in rendering the manure-trade what it now is, as a rule, namely—a well-regulated business, carried on by men of substance and character, possessed of skill and commercial knowledge and enterprise.

At present manure-dealers who have gained for themselves an unenviable notoriety can effect but few sales; whilst in the great majority of cases well-prepared, concentrated manures, though by no means of equal value, may now be bought in almost every market-town at much lower rates than the cost of similar fertilisers if prepared by the farmer himself.

Valuation-tables have been of great use in past times, and are still serviceable helps for detecting at once gross imposition;

they likewise afford important data in estimating the money value of manures.

But the gigantic dimensions which the manufacture of artificial manures has assumed during the past few years in this country, and the consequent altered conditions of the manure trade, necessitate not only several modifications in the prices at which the various constituents of artificials are valued, but likewise much circumspection in estimating by analysis and calculation the money value of a manure.

Having, in my capacity of Consulting Chemist to the Royal Agricultural Society, numerous samples of all kinds of artificial manures annually submitted to me for examination and opinion, and having, moreover, made myself practically acquainted with the manufacture of artificial manures, and attentively followed its rise and progress, I believe that I am in a position to say without hesitation that the true money value of a manure cannot always be calculated with anything like precision by mere reference to an analysis and certain valuation-tables. I feel inclined to go a step further, and maintain that, at the present time, such mere rule-of-three calculations frequently convey wrong impressions of the value of certain manures, and do not further the real interest of the consumer. In proof of this I may state that, not long ago, I saw a copy of an analysis of a manure, the commercial value of which, estimated according to the usual tables, was given at 11*l.* 10*s.* a ton, and yet this article was offered for sale at 7*l.* 10*s.* a ton. It may, perhaps, be presumed that this manure is manufactured under peculiarly favourable circumstances; but this is not an exceptional case, for the calculated value of certain superphosphates rich in soluble phosphate of lime is generally 2*l.* or 3*l.* higher than the price at which they are actually sold. On the other hand, it is no unusual occurrence to meet with really good and cheap fertilisers, which, submitted to ordinary commercial analysis, give apparently unsatisfactory results, inasmuch as their value, when calculated according to any of the approved tables, is set 1*l.* to 2*l.* lower than their true money value. Recent experience has convinced me that the buyer may now justly expect something more in a manure than the mere agreement of its calculated value with the price at which it is actually sold. It is, comparatively speaking, easy to prepare a manure say at 6*l.* a ton, the calculated value of which amounts to the same sum; but such agreement, in my opinion, is no guarantee that the manure is really worth that price. It is well known to all acquainted with the peculiarities of the trade in artificials that many samples which, as the saying is amongst manufacturers, "analyse well," can be produced at a

cheaper rate than others which do not analyse so well, but which, nevertheless, show a better result in the field, and possess a higher agricultural and commercial value.

I should much regret if these observations should induce any one to deny the utility of submitting artificial manures to chemical analysis. Without a correct analysis, not even an approximate estimate of the value of a manure can be given ; it is, therefore, and always will remain the most important and most indispensable instrument in conducting such an inquiry ; but there are other data likewise to be taken into consideration before the true money value of manures can be determined.

Believing chemical analysis to be of the highest practical utility, and fearing that discredit may be brought upon it by our "Manure Calculators," I am anxious to place in a propet light the ordinary money calculations which are given by most chemists with the analyses of artificial manures.

These calculations in many instances do not deserve the name of valuations, for instead of indicating what a manure is worth to the consumer and at what price it can actually be bought in the market, they show an imaginary value which in some cases is much lower, and in others much higher, than the price at which the manure can be supplied. Take, for example, the following numbers, which express the

Composition of a Sample of Superphosphate, selling at 6l. 10s. a ton.

Moisture	14·62
*Organic matter and water of combination	9·92
Bi-phosphate of lime	18·02
Equal to bone-earth rendered soluble	(28·12)
Insoluble phosphates	8·46
Sulphate of lime	42·15
Alkaline salts	2·34
Insoluble siliceous matter (sand)	4·49
	100·00
* Containing nitrogen	·59
Equal to ammonia	·71

An exceedingly simple method by which the value of artificial manures is calculated is to regard the analysis as representing the composition of 100 tons of manure, and to multiply each constituent by its assumed market-price per ton, and then to add up all the products. We thus obtain by calculation the price of 100 tons, and, by dividing this by 100, the assumed value of 1 ton.

The following list gives the price per ton of each constituent, according to the valuation-tables of Professors Way and Anderson, and Mr. Nesbit:—

	Way.			Anderson.			Nesbit.		
	£.	*s.*	*d.*	£.	*s.*	*d.*	£.	*s.*	*d.*
Organic matter	1	0	0	0	10	0	1	0	0
Soluble phosphate (*i. e.* bone-earth rendered soluble by acid)	33	0	0	30	0	0	24	0	0
Insoluble phosphates	7	0	0	7	0	0	8	0	0
Sulphate of lime	1	0	0	1	0	0	1	0	0
Alkaline salts	1	0	0	1	0	0	1	0	0
Ammonia	56	0	0	60	0	0	60	0	0

Calculated according to Professor Way's table we obtained the following value for this superphosphate :—

	Value per Ton.	£.		Total. £.
Moisture	14·62	..		..
*Organic matter	14·62 ×	1	=	14·62
Bi-phosphate of lime	18·02	..		..
Equal to bone-earth made soluble	(28·12) ×	33	=	927·96
Insoluble phosphates	8·46 ×	7	=	59·22
Sulphate of lime	42·15 ×	1	=	42·15
Alkaline salts	2·34 ×	1	=	2·34
Insoluble siliceous matter	..			..
	100·00			
* Containing nitrogen	·59			
Equal to ammonia	·71 ×	56	=	39·76
Calculated value, 10*l.* 16*s.* per ton.				£1086·05

Proceeding in the same manner, the price of the same superphosphate will be 10*l.* according to Dr. Anderson's, and 8*l.* 6*s.* according to Mr. Nesbit's table. Whether we take Professor Way's, or Anderson's, or Mr. Nesbit's tables, in either case there is a great discrepancy between the actual price at which this article is sold and its calculated value. Similar, and in some cases still greater differences can be noticed in the calculated and actual value of many samples of superphosphate, especially those made exclusively from coprolites and other mineral phosphates. It evidently appears from these facts that at the time when Professor Way, Anderson, and Nesbit drew up their valuation-tables soluble phosphate of lime could not be manufactured so cheaply as at present, and that consequently the price per ton of soluble phosphate now requires to be reduced, especially if Professor Way's or Dr. Anderson's figures are taken as standard values in the calculation, and the manure under consideration is entirely or principally made from mineral phosphates.

I purposely abstain from giving an amended price for soluble phosphate of lime, for such a price cannot well be fixed in a general way and then applied to particular instances.

The fact is, the commercial value of soluble phosphate of lime, like that of many other materials, depends in some measure on the source from which it is derived and the nature and the amount of other substances with which it is associated. Thus, soluble phosphates cannot be produced at as low a price when made from bones as from mineral phosphates. Then why not make it in the cheapest possible form? is a question which naturally suggests itself, but which is answered by the fact that in many instances bones partially dissolved in oil of vitriol produce a better practical result on the turnip-crop on light soils than a mixture containing an equivalent amount of soluble phosphate made from coprolites and insoluble bone-phosphate.

We thus see that it is not enough that there should be a certain amount of soluble and insoluble phosphate in a turnip-manure, but that the very source from which the fertiliser is obtained affects its agricultural as well as its commercial value.

A superphosphate containing, say, 15 or 18 per cent. of soluble, 15 per cent. of insoluble phosphate in the shape of bone, and 2½ per cent. of nitrogen, can be made much cheaper by producing in the first place the soluble phosphate from coprolites, and mixing the coprolite superphosphate afterwards with bone-dust and a certain quantity of shoddy, or a similar nitrogenous refuse material, than by making it entirely from bones. But as superphosphate prepared from bones has a better effect in the field and costs the maker more money, and thus has a higher commercial value than a manure which on analysis furnishes the same amount of soluble and insoluble phosphate and nitrogen, the constituents of a bone-superphosphate, and amongst them soluble phosphate of lime, must have a higher commercial value in this combination than in a mere mixture of dissolved coprolites, bone-dust, and a nitrogenous refuse matter.

Again, up to 28 or 30 per cent. of soluble phosphate (*i. e.*, bone-earth rendered soluble by acid), may be produced in a superphosphate simply by mixing phosphatic materials with a certain quantity of sulphuric-acid; but if a much higher proportion of soluble phosphate is required, recourse must be had to more complicated and expensive chemical processes; and these processes, of course, add to the expense at which the soluble phosphate is obtained in highly concentrated manures, such as Messrs. Burnard, Lack, and Co's. Concentrated Superphosphate, which contains no less than 44 per cent. of soluble phosphate.

Notwithstanding the increased expense in producing the soluble phosphate in a highly concentrated superphosphate, it may be good policy and economical to the consumer to prepare such concentrated fertilisers for exportation or for application in localities

where the cost of carriage of the diluents in ordinary manures amounts to much more than the extra expenses of the process of preparing the effective constituents in a highly concentrated form.

Since, then, in peculiar cases such a concentrated manure has a higher relative value for the consumer than an ordinary sample containing 18 to 22 per cent., and is prepared at greater cost by the manufacturer, it certainly would not be right to estimate the money value of the soluble phosphate in both at the same rate.

Another reason which deters me from attempting to fix a price for soluble phosphate—or, indeed, for any manuring constituent—is, that the price of the same substance in the same form varies continually from a variety of causes.

The commercial price of the raw materials employed in the manufacture of manures, like that of everything else, is dependent upon demand and supply, and regulates itself accordingly. The consumer, in my opinion, has a far better guarantee for a supply of cheap fertilisers in the competition of respectable firms than in the publication of any fallible, because constantly changing, price-list. There exists, moreover, the danger that the price-lists fixed by chemists of standing are frequently applied by others whenever it suits their purpose long after they have become obsolete. In the interest of the farmer I feel, therefore, bound not to publish an amended price-list of fertilising matters.

My attention has been directed to a remarkable change which has of late come over the minds of some manufacturers with regard to analyses and money-valuations: many of those who were once much opposed to such proceedings are now most anxious to have recourse to them for certain manures. The reason for this anxiety is obvious; for if scientific men whose names are well known to the public at large gravely state that manures which are actually sold at 7*l.* 10*s.*, according to the usual mode of computing their value, are worth 11*l.* 10*s.*, it is but natural that manufacturers should desire to secure so favourable though unreasonable a testimony. For years I have refrained from putting a money-value upon manures sent to me by manufacturers; for it strikes me very forcibly that if a maker has not sufficient chemical and commercial knowledge to determine correctly the money-value of his own productions, he has mistaken his proper calling.

Although the trade in manures is getting more and more into the hands of a limited number of intelligent and large manufacturers, there are still to be found, here and there, small and ignorant makers, and farmers who make a few hundred tons of artificial manures for their own use and that of their neighbours. Generally speaking, a manufacture carried out on such a limited

scale brings no advantage to the consumer, and seldom benefits for any length of time the producer, who has neither skill, capital, nor enterprise to compete with a firm which does a large trade. The price which a manufacturer has paid for his raw materials, including labour, carriage, bags, &c., is not necessarily a criterion of the worth of the manure, because he may have bought under serious disadvantages. A man who has not sufficient chemical knowledge will often select raw materials which are very good in appearance, but in reality cannot be employed so profitably as others; or he may not have sufficient capital to buy in materials which can only be obtained by taking a ship's cargo at a time; or, if he has capital, he may not have sufficient commercial knowledge and decision to take advantage of a favourable turn in the market. For these and similar reasons such a dealer will lose money if he sells the manufactured products at a rate which will yield a good profit to another vendor more favourably circumstanced.

In commercial analyses and calculations founded upon them, the form and condition of the several constituents is too often entirely overlooked. This is especially the case with respect to the state of combination and mechanical condition in which the insoluble phosphates and nitrogen occur.

Insoluble phosphate of lime may be present in any of the following forms: $\frac{1}{2}$ or $\frac{1}{4}$-inch bones, fine bone-dust, boiled bones, bone-black, bone-ash, coprolites, apatite, Estramadura phosphate, Sombrero guano, Peruvian guano, and phosphatic guanos.

Now, in most of these conditions, insoluble phosphate of lime has a different agricultural and commercial value. $\frac{1}{4}$-inch bones are more effective and cost more than $\frac{1}{2}$-inch; fine dust is still more expensive; and, generally speaking, the finer bone-dust is, the more powerful is its action and the greater the cost of preparation. When bones are acted upon by acid, but not applied in sufficient quantity to convert all the phosphate of lime which they contain into soluble phosphate, there remains in the mixture a certain quantity of insoluble phosphate, which, in this condition, is still more valuable than in that of fine bone-dust. On the other hand, the insoluble phosphates in animal charcoal (bone-black) and even bone-ash are of very little use in a turnip-manure. Of still less use to root-crops, if possible, are the insoluble phosphates in coprolites, apatite, and other mineral phosphate. Intermediate in their action between fossil phosphatic materials and bones are, perhaps, certain semi-fossilised guanos, whilst in Peruvian and several phosphatic guanos the insoluble phosphates are so extremely minutely divided that I am inclined to consider them worth twice as much as phosphates in the form of ordinary bone-dust.

It is, therefore, simply absurd to put the same value on insoluble phosphates, irrespective of the form in which they occur, since in a turnip-manure their worth may range from absolutely nothing up to 7*l.*, 8*l.*, or even 12*l.* a ton.

As regards nitrogen, this element may be present in the shape of an ammoniacal salt, or of nitrate of soda, or uric acid; or, again, in shoddy, whale-blubber, fish-refuse, horn and hide clippings, scutch, leather-refuse, and many other forms. In all these different forms nitrogen has a different agricultural and commercial value, and it is therefore unreasonable to assume the same price in calculating the money-value of the nitrogen which a manure may contain in so many varied shapes.

Besides this, some purely practical matters have to be well considered before a fair estimate can be given. In some instances superior composition in regard to ingredients may be more than neutralised by imperfect pulverisation or by a damp and lumpy condition, tending to inequality of distribution and irregularity in the growth of the crop. A fine state of division, dry condition, and uniformity of composition cannot be secured without a considerable increase in the cost of manufacture. No allowance, however, is generally made for this expenditure of money by our rule-of-three chemists; or if anything at all is allowed, the same manufacturing expenses are assumed whether the manure be fine, dry, and uniform, or the reverse. Injustice thereby is done to honest and skilful manufacturers, and at their expense the sale of apparently cheap but really inferior manures is encouraged. Is the manure dry enough to admit of equal distribution on the land?—is it very fine, or coarse and lumpy?—is it uniform in composition?—are the ingredients and their relative proportions in a manure really useful for the purpose for which the latter is recommended?—what facilities are there in a particular locality for procuring the required fertilisers?—and many similar questions that do not enter for a moment into the mind of a mere "calculating machine" require to be well weighed before anything like a just estimate of the money-value of a manure can be given.

In a highly-concentrated, well-prepared superphosphate, I have already noticed that soluble phosphate has a somewhat higher commercial value than in an ordinary sample. Concentration or dilution of all the more effective fertilising constituents similarly affects the commercial value of other manures. It is therefore evidently unfair to take as a standard the price at which ammonia, phosphates, &c., can be purchased in Peruvian guano, in calculating the money-value of nightsoil, sewage, and other bulky fertilisers.

A very striking example, showing how much bulky and, com-

paratively speaking, valueless materials reduce the money-value, is presented to us in farmyard-manure. One ton of fresh yard-manure of fair average quality, I find, contains:—

	s.	d.
6¼ lbs. of soluble phosphate of lime, worth, at 3*d*. per lb.	1	7½
8¼ lbs. of insoluble phosphate of lime, worth, at 1*d*. per lb. ..	0	8½
12½ lbs. of potash, worth, at 3*d*. per lb.	3	1½
15 lbs. of ammonia, worth, at 6*d*. per lb.	7	6
Total	12	11½

Whilst, thus, the calculated value of farmyard-manure is nearly 13*s*. per ton, its real commercial value is about 5*s*. per ton.

Again, before certain manures could be obtained that are now specially prepared to suit particular soils or particular crops, enterprising and intelligent manufacturers have frequently incurred heavy expenses in trying all kinds of fertilising mixtures before they succeeded in ascertaining the states of combination, and the relative proportions in which these should be combined in order to produce the best practical results. It is, therefore, but fair that those who profit by these researches should repay the manufacturer for the time, skill, and expense which he has bestowed upon the production of such special manures. In estimating the money-value of such fertilisers this ought to be taken into consideration, and allowance be made for more than the mere market-price of the several uncombined ingredients.

Perhaps it may be suggested that all these observations only tend to show the inability of the chemist to give a reliable estimate of the money-value of a manure. I openly confess concurrence in this sentiment if the name of "chemist" is applied to a mere human analysing and calculating machine, or even to a purely theoretical man of science; but strongly repudiate it if it indiscriminately refers to every chemist.

The errors committed by purely theoretical men, and the carelessness and ignorance of others who call themselves agricultural chemists, show incapacity in individuals; but they do not prove that men who, without presumption, may lay claim to the office of an agricultural chemist, are not in a position to render most useful services to the farmer by informing him whether the manures sent for examination are cheap, dear, or moderate, at the price at which they are offered for sale. Unquestionably, a considerable amount of commercial and agricultural knowledge as well as judgment, and the fixed determination neither to favour producer or consumer, are quite as essential qualifications in an agricultural chemist as analytical skill; but those agricul-

tural chemists who possess the somewhat rare gift of uniting sound scientific knowledge with good sense and acquaintance with practical matters, assuredly are, or ought to be, in the very best position properly to estimate the agricultural and money value of manures.

XVII.—*Account of the French Experimental Farm at Vaujours.* Abridged from its 'Annals' by P. H. Frere.

Abstract of Contents.—General Description — Drainage — Cost of Apparatus for Irrigation — The Night-Soil of Paris — Mode of applying Night-Soil — Course of Events at Vaujours — Lodgment of Crops — Balance-Sheet, 1860 — Experiments — Plan for future Cropping — Conclusion.

Some few English farmers are probably aware that an Experimental Farm has been established in France to test the value of the sewage or night-soil taken from the cesspools of Paris, and the economy of its application by means of steam-pumps and the tubular system of irrigation. Not having heard further, they probably surmise that its career has not hitherto been a decided success: more than this they have not learned, and, if men of the old school, they do not care to inquire. Yet, if we look around, the sources of agricultural advancement are not so numerous nor so promising that we can afford to overlook even a slight prospect of reward: nor, again, are exact, trustworthy, detailed accounts so common or so easy of access that any such specimen can be passed by. Quite apart from the economical results obtained, such accounts, when conscientiously drawn up, are of great service to an art so poor in statistical knowledge as agriculture. If we can put them to no other use, we may dissect them with profit, as the Parisian shawl-merchant remodels the products of Cashmere when the pattern is not to the French taste. That these accounts are in this case conscientiously framed appears on the face of the reports; indeed, in the liberal allowance made for wear and tear of dead stock, &c., they contrast very favourably with some of our one-sided estimates; and for this the more credit is due, because from various mischances a serious deficit had to be faced.

There is further reason for approaching these records in a kindly spirit, because the vituperative element does not enter into them. There is no preface of promiscuous and exaggerated invective against farmers and farming generally, in terms that are almost insulting to the very men whose ear it is most important to gain,—men who naturally repudiate the fancy-portrait

To face page 287.

TABLE SHOWING THE CROPPAGE IN 1860.

Letters.	Crops.	Area.	Grass.	Corn.	Plants.	Roots.
		Hect.				
C 1	Wheat after Beet . .	1,50	. .	1,50	. .	. .
i 1	Poppy or Green Rye, then Cabbage .	1,50	. .	. .	1,50	. .
r 1	Beet	2,37	. .	. .	. .	2,37
r 2	Potatoes	0,60	. .	. .	. .	0,60
P 1	Lucerne	10,00	10,00	. .	. .	. .
P 2	Lucerne	1,60	1,60	. .	. .	. .
P 3	Swamp drained .	1,00	1,00	. .	.	. .
r 3	Potatoes and Cabbage .	0,60	. .	. .	.	0,60
g	Marsh	. .	.		.	. .
C 2	Wheat	2,80	. .	2,80	. .	. .
C 3	Wheat	2,50	.	2,50	.	. .
C 4	Wheat	1,00	. .	1,00	.	. .
C 5	Wheat and Oats .	4,00	. .	4,00	. .	. .
C 6	Oats	2,80	.	2,80	. .	. .
C 7	Oats	2,80	. .	2,80	. .	.
P 4	Pasture	32,00	32,00	. .	. .	. .
i 2	Winter and Spring Rape	4,00	. .	. .	4,00	. .
i 3	Winter Turnips . .	3,00	. .	. .	3,00	.
i 4	Ditto	1,00	. .	. .	1,00	. .
P 5	Rye Grass . . .	0,50	0,50	. .	. .	. .
P 6	Ditto	4,00	4,00	. .	. .	. .
P 7	Ditto	0,40	0,40	. .	. .	. .
P 8	Ditto	0,60	0,60		. .	. .
	Total . .	. .	60,10	17,40	9,50	3,57

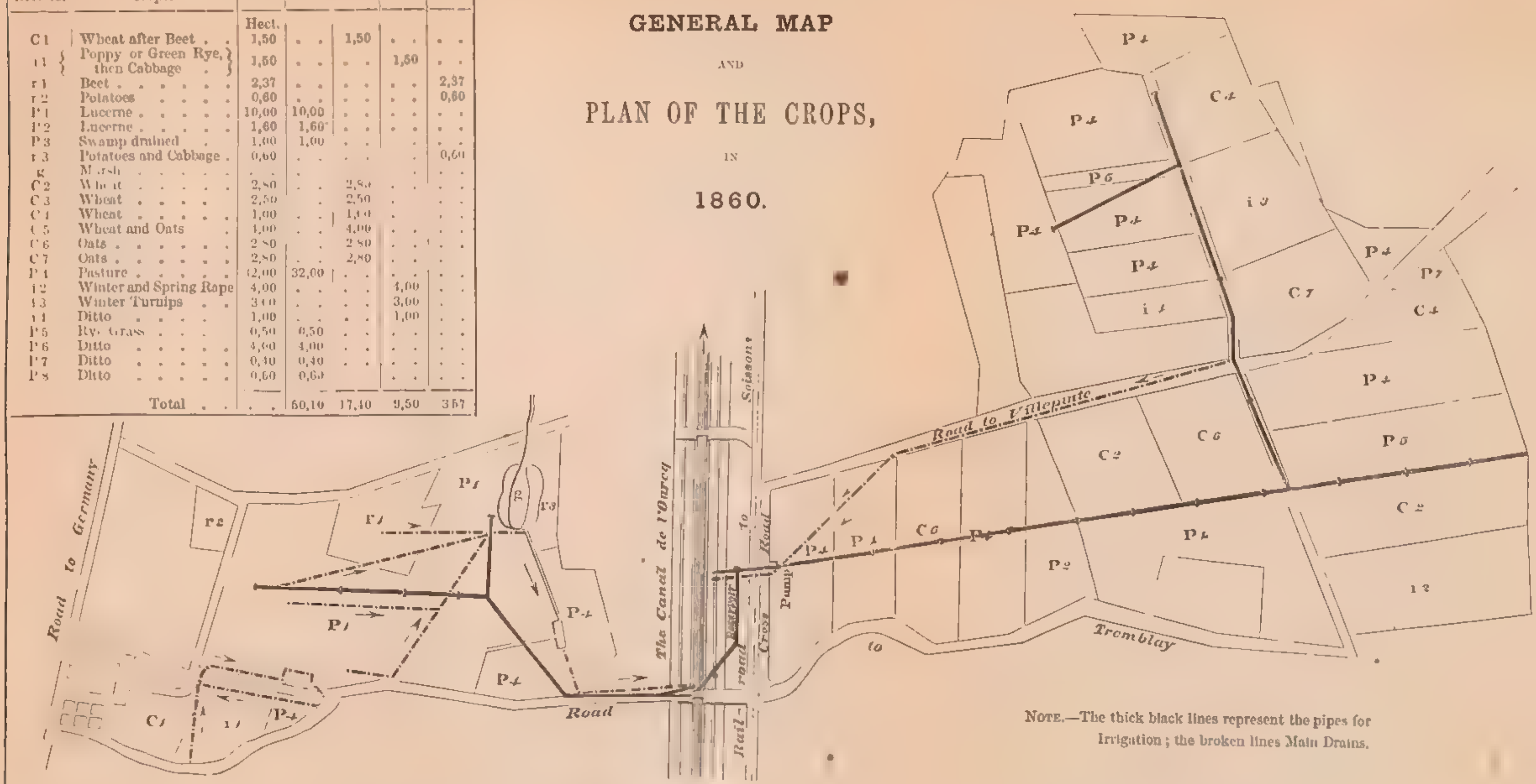
GENERAL MAP

AND

PLAN OF THE CROPS,

IN

1860.



NOTE.—The thick black lines represent the pipes for Irrigation; the broken lines Main Drains.

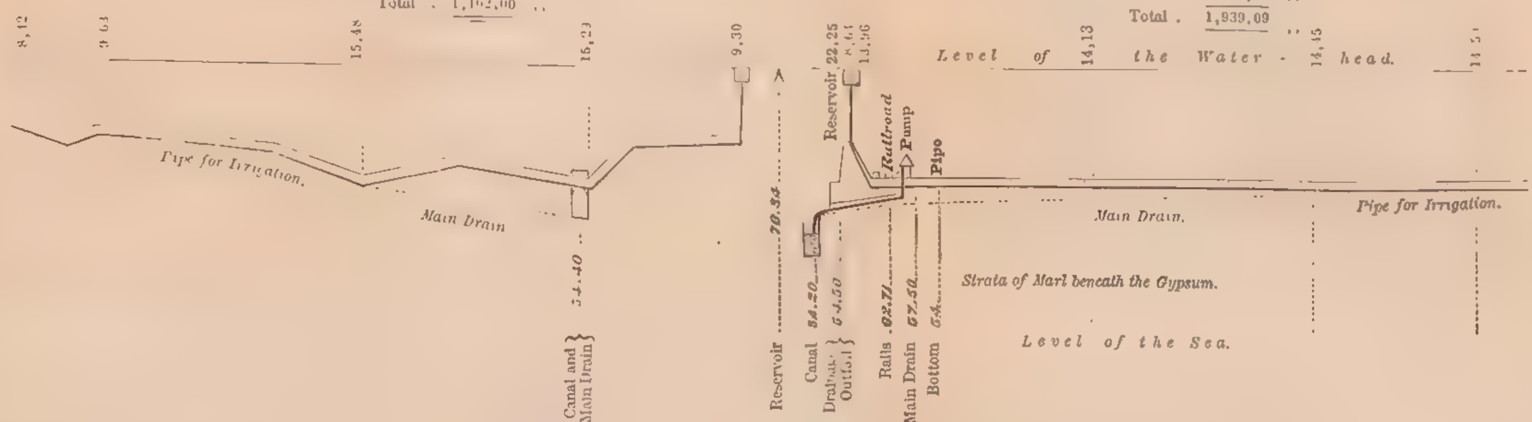
SECTION FOLLOWING THE LINE OF DISTRIBUTION.

MAIN PIPE.

LEFT BANK.—Principal Line . . 989,00 Mètres.
Branch . . . . 113,00 ,,
Total . 1,102,00 ,,

MAIN PIPE.

RIGHT BANK.—Principal Line . . . 1,553,00 Mètres.
Right Branch . . 274,00 ,,
Left Branch . . . 112,00 ,,
Total . 1,939,09 ,,



drawn of themselves and their brethren,—who, though not the pioneers of progress, are in the van, and moving steadily onward, observing and reflecting, though not called upon (or, indeed, warranted) to risk their means in ventures where the follower is pretty sure in the end to outstrip the leader.

Such men will look with interest on the efforts of others who are blundering on towards knowledge and skill. For them the work is being cut out; something will come of it by which themselves may profit. For the man of another stamp—the ardent amateur—these annals may serve as a useful warning, that however bright and well-founded his conception may be, its practical success will depend on numerous adjustments in the relations of soil, climate, markets, supply of labour, and state of civilisation, which prevent any agricultural "spurt" from being profitable. All who will, may pick up some useful hints; whilst those crusty friends of agricultural progress in the abstract, who chuckle at the miscarriage of every individual project, may enjoy their laugh *for a season.*

It would seem that in the year 1856 a company was formed in shares amounting to 100,000 francs (4000*l.*) for starting this Experimental Farm of 220 acres, situated at the distance of 12½ miles from Paris, in the midst of the Forest of Bondy—a name suggestive of robbery and violence. The choice of the site was evidently determined by the proximity of a canal, which intersected the farm and brought from Bondy in barges the 10,000 tons of night-soil which the company undertook to apply to the land, on which condition the municipality of Paris contributed 30,000 francs (1200*l.*) to the enterprise, to which the French Government added an annual subsidy of 160*l.* to start the enterprise, with a stipulation that its experimental and scientific character should be maintained.

It was, indeed, an experimental rather than a model farm. Its site appeared at first to be at the world's end, for the public roads leading to it had been neglected, because hardly needed, and farm-roads it had none, neither materials for making them. The farm, as will be seen by the accompanying map, consisted of two narrow strips on either bank of the canal; the buildings stood at one end of the smaller area,—no slight obstacle to carrying out liquid manure, as at first practised, in carts, and to bringing home bulky forage crops, since it took, on an average, half-an-hour to convey a load to the chief allotment of land on the other bank; this inconvenience also led to the horses finishing the day's work of ploughing in one journey. The land was poor and foul, mostly heavy, and requiring drainage, for which an artificial outfall had to be procured by means of a costly main drain. Their labour-

market combined all the evils of proximity to Paris with the drawbacks of a wild, secluded spot. Under the influence of the adjacent forest the climate was cold and damp, and affected by fogs which seem to rival those of London; but a yet worse mischief haunted the woods—those pests, the rabbits! I shall have occasion to quote at length a very spirited letter on this head, which will doubtless excite much sympathy from English fellow-sufferers, and some surprise and wonder how such an evil can have survived, or revived after the clean sweep of feudal abuses which was made in France under the First Revolution. Besides the command of water-carriage and the prospect of approaching railroads, there was little to balance these drawbacks but the advantage of having a liberal landlord, Mr. Smith, who undertook, when called upon, to provide money for roads, drains, &c., charging 6 per cent. on the outlay, to the amount of 1200*l.*

The Canal de l'Ourcq, which intersects the farm in a bed nearly 9 yards below the level, was a work of the First Empire. The requirements of this canal for a supply of water led to the drainage of the property (which had been a swamp in winter), and paved the way for thorough drainage.

In 1852, the Eastern Railroad came within 6 miles of the farm: recent improvements have led to the erection of a station at the distance of about 4½ miles; and in 1860 another line opened a station less than 2 miles off.

It further appears that the depôt for the night-soil of Paris, from the formation of new suburbs, will have to be removed from Bondy to the immediate neighbourhood of this land, so that about one mile of good metalled road is alone wanting to put this once secluded spot into direct contact with Paris, and with other towns in which sugar-refineries and distilleries are in full play. These are important elements of future success.

The benefits to be anticipated from the extension of the railroads were, however, for a while attended with serious drawbacks. The construction of the Northern line interposed between the engine-house and its field of operation, necessitating the removal of the former, and consequently the suspension of irrigation by pipes until June, 1860. It likewise so interfered with the drainage outfall as to call for new main-drains and the deepening of the tunnel which passed under the canal in dangerous proximity to the reservoir. These works were begun in the autumn, with disastrous results; the contractor failed, yet the work had to be carried out at all hazard and any sacrifice, amidst rain and frost; hardships and danger to the workmen, and with haulage destructive to the teams of the farm. The work cost 200*l.* instead of 80*l.*, the sum contracted for.

Drainage.

Drainage was on this farm a necessary preliminary to irrigation; but as it was estimated that for the 217 acres this work would cost 1200*l.* (or nearly 5*l.* 10*s.* per acre), a loan was required. When an application was made to the Company of the "Crédit Foncier," the formal preliminaries required were found to be so tedious that the landlord, Mr. Smith, came forward and offered to make the required advance on the same terms as those prescribed by the company.

M. Barbier, a well-known engineer, was employed to plan and superintend the work, which was surveyed, certified, and paid for by the Government Engineer of the district. As the work proceeded, the necessary advances were made, bearing an immediate interest of five per cent. The land of the left bank, 42½ acres, has been already drained.

Main drains, 2¾ inches in diameter, following the contour of the undulating surface, converge towards the old fen, in which basins have been formed to act as sinks (*fossés à cuvette*). Pipes of 1·18 inch bore are laid from 13 to 16 yards apart, at a mean depth of 51 inches, in a bed of clay mixed with sand and marl. To complete the circuit, air-drains are carried along on a higher level, just as the head drains follow the depressions. The apex of the system is indicated by an air-chimney, in like manner as is the lowest point of outfall by the well which acts as a cesspool. "There is thus a double circulation; whilst the water flows downwards the air is constantly mounting upwards, penetrating the soil and conveying oxygen to the manure which is being consumed and transformed by the process of slow combustion."

Lastly, from the lowest point in the fen a 12-inch tunnel is run to the Bridge of Villepinte at a depth of 13 feet, where it empties in a cascade into the canal the drainage water from the left bank.

At the date of the publications referred to the work on the right bank was still incomplete, there being here greater difficulties to contend against, arising from want of fall and difficulty of securing an outlet, which made it necessary to deepen the tunnel and to construct main drains in boiling sand. As far as it has gone, the work has cost 6*l.* per acre, but the outlay cannot be fairly stated till the work is finished.

Piping.

Next in importance to the work of drainage, if not in this case of more special interest, was the organisation of the apparatus for irrigation, which was a work of time.

The entire outlay made for this object was as follows :—

	£.	£.
1. Labour :—		
Earthwork, making quay for barge, and cutting trenches	108	
Bricklayer and carpenter for tunnel, shed, tank, &c. ..	236	
	——	344
2. Implements :—		
Letestu's pump, which lifts 25 tons per hour	100	
Gargan's moveable steam-engine, 6 horse-power	272	
	——	372
3. Pipes :—		
3000 mètres (3250 yards) of iron pipe (bituminé), $4\frac{1}{5}$-inch, at 5*s.* per mètre, including fixing	720	
Stop-cocks, valves, &c.	96	
Moveable pipes, Gargan's plan, with bayonet joints ..	96	
Contingent expenses	56	
	——	968
4. Plant :—		
1 barge, holding 40 tons	60	
3 water-carts, at 8*l.*, and 1 hand-cart	32	
	——	92
5. General charges :—		
Engineer for superintendence	28	
Miscellaneous charges	24	
	——	52
(Mis-stated as 1800*l.*)		£1828

The company, acting as a pioneer for others, has paid dearly for its experience. It is elsewhere estimated that this work might now be executed for little more than two-thirds of the original outlay. As it is, the great bulk of the land has been brought directly under the tubular system, whilst the few outlying pieces not so circumstanced are within easy reach of the cisterns; and this has been accomplished at an average cost of 8*l.* per acre for the 225 acres of which the farm is composed—an outlay which may be compared with Mr. Blackburn's estimate of 214*l.* for 20 acres, given in p. 14 of this volume.

Moveable Pipes.

Moveable pipes, as it is stated, are often made of leather, canvas, gutta-percha, or india-rubber; but breakages, contractions at the points of flexion, and rapid wear are against the use of such organic substances.

Following in the track traced out by Lord Essex, by Mr. Harvey of Glasgow, and the works in the Bois de Boulogne, the Directors at Vaujours employ moveable pipes made of plate-iron $2\frac{6}{10}$ inches in diameter, and 8 yards 2 feet long, this being the greatest length which the works can turn out; to the end of the pipe is attached a tube of india-rubber $2\frac{1}{2}$ inches in diameter, strengthened inside by a spiral thread of iron-wire; sufficient play at the joint is thus attained without any diminution in the size of the conduit;

next to the india-rubber at the left end comes the male screw of a bayonet joint; at the other end is the female screw with the bayonet attached; the joint is united to the pipes by an iron collar; a half-turn of the screw suffices to make all fast. Nothing is easier than the carriage and adjustment of these parts; one cart will carry enough to form a conduit 200 yards long; the workmen bear a length of pipe on their shoulders to its resting-place, the ends are supported on a wooden X to make a join; a boy is left at the stop-cock to open or shut it as directed, and an assistant levels the surface with a rake. The foreman works the hose, and carries, coiled up at pleasure, the short length of india-rubber which forms the last section in the channel.

To give an idea of the work performed, it may be stated that in April about 1000 tons were applied in 25 days, or 40 tons per day. Since the morning was spent in fetching the "soil" by barge from Bondy, the machinery working in the afternoon made only half a day of work. In the dry season, when the "soil" is diluted with three times its bulk of water, the machinery was in full work, and distributed 150 tons per day. "The price of a length (8 yards 2 feet) of moveable tube ($2\frac{6}{10}$-inch gauge) is about 8*s.* 4*d.*, or double the price of a fixed conduit of the same bore. It is laid with such ease, and the joints are so well secured, that a $4\frac{1}{5}$-inch gauge might be safely used instead of the smaller size, so as to form a continuous channel of the same diameter from the point of suction to that of distribution. This would be sound economy in regard both of the discharge of the fluid and the hand-labour required."

Paris Night-Soil.

Our interest in this enterprise centres on its employment of the *vidange* or night-soil of Paris, on the economy of its application, the crops to which it is naturally adapted, the best time and modes of applying it, and, lastly, on the hindrances, restrictions, and changes of plan which season and climate, state of markets, and supply of labour have imposed on that application.

This *vidange* must not be confounded with the sewage of English towns; it is night-soil derived from the cesspools or pits with which the houses are generally furnished. These are emptied once or twice in a year at night by carts furnished with a pumping apparatus which adjusts itself to an orifice connected with the pits. The carts then convey the soil to a great sink (*dépotoir*) placed at the outskirts of the city, from whence it is forced by steam-pumps through a tunnel to the great reservoir at Bondy, where it is either dried and manufactured into "Poudrette," or conveyed to the farm reservoir in barge-loads of 40 tons along the Canal de l'Ourcq.

It appears from analyses that a cubic mètre of this Paris "soil" (about a ton) contains 3½ kilogrammes of nitrogen, or about 7¾ lbs. = 9½ lbs. of ammonia, the salts left after combustion amounting to nearly 19 lbs. On the other hand, an average ton of London sewage (according to Professor Voelcker's analysis) contains only 3½ oz. of ammonia, and 2 lbs. of mineral matter, of which ½ oz. is phosphorus, and 1½ oz. potash. The *vidange* of Paris therefore contains forty times as much ammonia in a ton as the sewage of London.

Means of Application.

Next to the consideration of the fertilising powers of this night-soil comes the question of the most economical means of applying it, which M. Moll thus discusses.

The barrel mounted upon wheels, either with or without appliances for the even application of the fluid, has been in use from time immemorial in Belgium, in the northern departments of France, and in Western Germany. It has the advantage of simplicity of construction, and consequently of small outlay in the first instance; but in the end its employment is neither simple nor economical.

It has been my fortune to employ under the same circumstances the tubular system in its integrity; that same system, both aided by gravitation and also in conjunction with the water-cart; and lastly the cart filled by hand, and emptied either by direct action or the use of the "tub and scoop." The estimates I shall give are based on extensive trials, if not on continuous practice.

A few preliminary remarks are desirable. When liquid manure is applied to growing crops the dressing must be much diluted: if it be urine ('*purin*'), with three or four times its bulk; if night-soil, with five or six times as much water. Unless a favourable moment can be seized during or after rain, the dressing should be much more diluted than this. But at such times, from the wet state of the surface, the passage of the cart is often highly prejudicial to the land. The cart, then, cannot be well employed for growing crops in the season of their growth, neither is it suited to winter use.

Any attempt to distinguish between the use of concentrated and diluted manures on the same farm, with a view to the employment of the cart in the former case, must practically prove a failure; the mode of application will vary for different crops.

The importance which some of the opponents of the tubular system attach to the employment of gravitation as a motive power, shows how little they are familiar with the subject. The great cost of this system consists not in the moving power or the apparatus required for laying on the liquid, but in the pipes. Even in our unfavourable position, where the boat to be

unloaded is from 10 to 16 yards below the level of the fields, the cost of working the moveable engine and pump comes to only one-fifth of the total cost of the apparatus. With a fixed engine it would be one-sixth, and with a horse-power only about one-tenth of the whole charge. In spite of this, of the high price of coals at Paris, and also of the drawback that our apparatus has not been in full employment—performing only half or one-third of the work which it will have to execute in future—it nevertheless costs us only 1$\frac{3}{4}$*d.* to lift and spread one ton of liquid manure; of which cost the coals, oil, and labour come to 1*d.*, and the interest and wear and tear $\frac{3}{4}$*d.* (8$\frac{1}{3}$ per cent. being allowed for wear and tear). The application of gravitation would then save $\frac{3}{4}$*d.* per ton; yet this rate, low as it is, is quite exceptional, as the following facts will prove.

In the South of France a considerable extent, not only of gardens but also of arable fields, is irrigated by machines, set in motion by the wind, by steam, and even by horses and mules. From many data collected on the spot, M. Gasparin ('Cours d'Agr.,' vol. ii. p. 457) gave the following estimate of cost.

The cost of raising to a height of 13 feet the 10,000 tons of water required for irrigating a hectare (2$\frac{1}{2}$ acres) of land is:—

	£.	*s.*	*d.*
By horse-power	5	2	6
„ wind .. .. from 3*l.* 4*s.* to	8	0	0
„ steam-power (5-horse)	1	18	6
„ steam-power (45-horse)	1	12	6

When it is a question of applying, not 10,000 tons of water, but a fertilising manure, which when diluted with, say four times its bulk of water, will not exceed 100 tons per acre, or at the outside 140 tons, it is evident that, even if the cost of pumping were two or three times greater than this, it would still be an insignificant item in the expenditure.

The respective cost of the liquid manure, when applied at Vaujours by barrel and steam-power, is as follows:—

Cost per Ton of Liquid Manure laid on by Carts.

	Fr.	c.
Prime cost of "soil" per barge-load of 40 tons ..	42	0
Canal charges	10	60
Mean cost of emptying barge (15 fr.) and carting say 800 yards *	59	35
	111	95

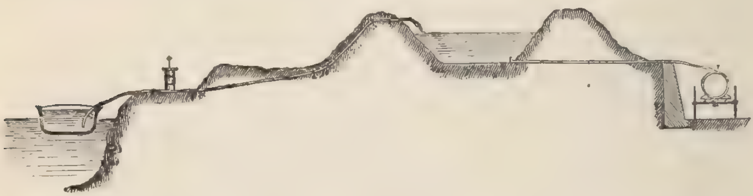
Or 2fr. 80c. (nearly 2*s.* 4*d.*) per ton.

The state of the roads made this difference, that when they were bad we were obliged to harness three horses to a cart.

* The cost is estimated for two distances of 540 and 1080 yards. When the roads are bad, the cost is increased by one-third, and it varies from 22 to 45 francs.

When everything was in good order we emptied a barge-load per day with two carts; but in the winter of 1857-58, from the defects either in the pump or the roads, this work occupied one and a half, or even two days.

A further sum of *2d.* per ton must be added to this for wear and tear of dead stock; which is calculated at $8\frac{1}{3}$ per cent. ($\frac{1}{12}$ "*par an*") on 200*l.*, the value of the barges, pump, and carts, and the amount divided between 2000 tons of manure. No account is taken of springs broken, carts damaged, and manure lost by accidents. The annexed illustration shows the relative positions of the canal and barge; the reservoir and the tap from which the barrel-cart was filled:



Some small portions of the farm are still irrigated from the cart, which is readily filled at the nearest point of the moveable conduit by a perpendicular pipe.

This pipe acts as an hydraulic crane; a canvas arm conveys the liquid to the bung-hole at such a rate as to fill 1 or $1\frac{1}{4}$ ton in two minutes. The distribution has been much simplified by an improvement suggested by M. Moreau, an agriculturist of Sevran; an orifice, nearly 2 inches wide, made at the bottom of the cart, is closed by a stopper, which is removed by a horizontal lever; as the liquid flows, it falls upon a small metal cone (a mushroom head), and thence is diffused to the width of the wheels. As the horse moves, the liquid paraboloid applies a well-defined shower without gaps to the surface of the field. By these means the dressing is perhaps more evenly applied than by the hose.

Such a cart, with fittings, complete, costs 12*l.* 16*s.*

Cost of Liquid Manure laid on by Steam-power and Pipes.

The emptying and applying a barge-load by steam-power and pipes will occupy half a day, and will cost:—

	fr.	c.
For fireman and bargeman	3	0
„ coal and oil	1	50
„ foreman and assistants distributing	4	65
	fr. 9	15

	fr.	c.
Or per ton	0	22·3
Add charge for wear and tear, per ton	0	46·2
Prime cost, per ton	1	05
Canal charges	0	26·5
Total cost per ton (20*d.*)	fr. 2	0

When the manure was delivered through the pipes, if the pump worked well and the manure was free from solid matter, a barge was emptied in two hours, though half a day has been allowed in the above estimate.*

A trial was made of the Belgian fashion of applying liquid manure. On this plan, the cart is halted at the edge of the field. The cart is emptied into tubs with handles, of the size that two men can carry between poles, which are so put down that a circle having a radius of from 10 to 16 yards may be watered by the contents of each, about 33 gallons. The trial was made with mangold of considerable size, not well suited for watering by a jet. The workmen were not experienced in labour of that sort; but, on the other hand, they were always within 80 yards of the cart, whereas in the North they travel as far as 200 or 300 yards. The cost was as follows:—

	s.	d.
For 2 workmen	5	0
Carter	2	6
2 horses (8 frs.)	6	8
	14	2

The men emptied 16 tubs, containing 528 gallons, at a consequent cost of 5*s.* 10*d.*; or, including the charge for dead stock, 6*s.* per ton. It must be admitted that with 2 water-carts, 1 team, and from 14 to 16 workmen, if the roads be good and the distance do not exceed 3 furlongs, 15 tons per day might be distributed. The wages for 14 workmen and a carter would then amount to 37*s.* 6*d.*; the horses, as before, to 6*s.* 8*d.*; and the price per ton to about 3*s.*; or, if the charge for pumping and dead stock be added, 3*s.* 4*d.* per ton.

It is here assumed that the work goes on smoothly, without hindrances, which is rarely the case; and still it appears that this highly-vaunted system costs 2½ times as much as delivery direct from the cart, 4½ times as much as that from the cart filled from the main pipe, and 6 times as much as irrigation by the jet.

These results are in conformity with the general law of pro-

* Some corrections are afterwards made which raise the cost of distribution through pipes to 2*s.* 2*d.* per ton, in consideration of a deficiency in the amount of manure distributed, and an increase of the cost of the apparatus above the estimates.

gress, which teaches us so to increase the primary cost of outfit as in a yet higher degree to increase the aggregate of work done. The pitcher, the rope and bucket, the hand-pump, the horse-power, the giant pumps worked by steam, are successive stages of development. Whilst a ton of water raised 13 feet by the common pitcher costs from 4*s.* to 5*s.*, when lifted by the drum-pump (*tympan*) and 45 horse-power engine on the estate at Laissel (near Arles) it costs only 1-25th of a penny. These great results are, however, only obtained when the machinery is in full play, or, at least, in pretty constant employ. Steam-power far surpasses horse-power if it works from 250 to 300 days in a year; when used from 150 to 200 days the advantage is not so great; if working less than 100 days its superiority vanishes, or is changed into a disadvantage.

This question of sufficient employment has been the weak point in our tubular system of irrigation. Generally, where this system has been adopted, the engine, besides devoting 130-150 days to this work, is employed during the rest of the year in thrashing, grinding, slicing roots, churning butter, &c. At Vaujours this course could not be adopted, because it was necessary to place the pump and engine on the canal bank, 1200 yards from the homestead; but measures will be taken for finding profitable employment for this leisure-time. The chief items in the outlay for irrigation being for fixed and moveable piping, which cannot be applied to any other purpose, it is an important question whether these pipes can be provided with sufficient employment, so that the charge for their use may not press too heavily on each ton of liquid applied.

And here it may be observed that the wear and tear of the moveable pipe is proportionate to the work it does, and that over the fixed pipe the charge for interest and wear and tear may be set at a very low rate, 5 or even 3½ per cent. being sufficient.

The economy of this system, according to English experience, turns upon having a supply of liquid manure proportionate to the number of acres to which pipes are applied. What, then, is this proportion?

Lord Essex, one of the most distinguished advocates of the tubular system, considers that, when the manure applied is derived solely from the urine of the cow-stock, 7 cows, at least, per acre are required to furnish the supply. By converting a part of the solid into liquid manure, or by the addition of guano, these proportions may of course be varied.

The farm of Vaujours, having the command of an unlimited supply of rich manure, is more favourably circumstanced than others in this respect. Here, therefore, pipes could, without imprudence, be laid under 150 out of 225 acres; the tax for the

"plant" falling less heavily on each acre in proportion as their number was increased.

Various considerations caused the work to go no farther: expense, the irregularity of the outline of the estate, and, lastly, the improvement made in our distribution from the cart by the use of the "hydraulic crane" affixed to the portable tube. The cart is still generally inferior to the distributor; but if it can be filled at a short distance from the point of application to small outlying fields, and favourable moments be seized for work, it may be managed on a small scale. Such cases are quite exceptional.

By an improvement introduced at Vaujours in the arrangement of the main pipe, its length does not exceed 22 yards per acre; in England 24 to 28 yards are commonly required.

Mode of applying Liquid Manure.

The amount of liquid manure to be applied should not generally exceed 20 tons per acre for cereals; but for forage crops, when one dressing is laid on in winter and two in summer, this quantity may be exceeded.

Summer dressings should be diluted three or four fold with water, of which an adequate supply has been procured, which the drainage-water will still further increase.

Perfection in the admixture and application of the two constituents has not yet been attained, and the course of action was much interrupted and intermitted.

First, *a given* quantity of sewage is lifted from the barge into the reservoir, which is then filled up with water. The contents are well stirred, and then distributed. Whilst the distribution goes on both engine and pump are idle, and the workmen are unemployed while the reservoir is being filled; but nevertheless the suction of the pump is so much improved, and the service-pipe works so well with this admixture, that the reservoir is emptied three times in a day, and 160 tons of dilute sewage applied,—a sufficient dressing for from $3\frac{3}{4}$ to 5 acres. Various neighbours now come to buy sewage at the cisterns for the adjacent fields, and the corporation of Paris have sanctioned the sale on the payment of a royalty of $2\frac{1}{2}d.$ per ton.

The Course of Events.

We shall, perhaps, best describe the general career of the farm up to the end of 1860 by stating that times and events seem, for the most part, to have been sadly out of joint for this enterprise. The seasons fluctuated between the extremes of cold and wet. At first, for want of water and the use of the pumping apparatus, sewage was applied undiluted from the barrels late in

spring, and, encountering the heat of summer, burnt up the crops, acting "like oil poured on a fire." When these difficulties were overcome, and copious diluted dressings economically applied, the weather altered, and exuberance of growth only resulted in disastrous "lodgment," which damaged not only cereals and rape (grown for seed), but rotted and spoiled the forage crops. For such disasters in 1860 bad luck may be better pleaded than in most instances where there is a question at issue between mishap and mismanagement. From the state of the roads the home-lying fields had been gorged with manure, the distant ones left in a state of beggary, which the recent substitution of deep for shallow cultivation did not tend to relieve. The climate, too, was fickle and exceptional in this forest "clearing;" the temperature being nearly 4 degrees below that of Paris. When the sewage, which had burnt the first crop of grass, told splendidly upon the second, which promised to yield upwards of two tons of hay per acre, it was a natural but a rash proceeding to make hay in October and November in this land of fog and mist.

A flock of sheep was started, but showed no signs of having the golden hoof, for they figure in the balance-sheet of 1859 as responsible for a loss of 80*l*., and for 148*l*. in that of 1860: the fact being that they had to be bought when all the world were purchasers, and sold off when others also were clearing out. Their winter's food, moreover, appears to have been chiefly rye-grass-hay and water, precisely that which Mr. Lawes apologises for giving experimentally, to test the animals' utmost powers of assimilating woody fibre, at the sacrifice of profit. Yet at this very same time beet was being carted for sale to factories at an unremunerative price! This was running in the ruts of French custom, and abiding too rigidly by the sound principle that this farm, commanding as it does an ample supply of sewage-manure, should not keep back marketable produce for stock-feeding and conversion into manure. A prospect of an agreement for taking in sheep at 2*d*. per head per week, between September and December, appears to promise an escape from serious losses.

Amongst minor nuisances affecting the corn-crops, the rats figured considerably. To the forest-rat wheat was an unusual treat: there was no grain in the neighbourhood except in the lath-and-plaster barn of Vaujours. In 1858 some thousands of the sheaves (the last thrashed) yielded next to nothing. Cats have since been at a premium.

But it would not be fair to attribute all losses to amateur or experimental farming. In the years 1859-1860, throughout the north of France, agriculture suffered severely, and especially in localities which in soil and climate resemble Vaujours.

The following quotation from the 'Echo des Halles' will set the falling off of the wheat-crop in a clear light. "In 1858 the average produce of a hectare of land was 30 hectolitres, weighing 78 kilos.; 100 kilos. of wheat gave 75 kilos. of flour; and 100 kilos. of flour made 141 kilos. of bread. In 1859 the average produce per hectare was 20 hectolitres, weighing 72 kilos.; 100 kilos. of wheat gave 75 kilos. of flour; 100 kilos. of flour made 137½ kilos. of bread. In 1860 the average produce was 18 hectolitres, weighing 70 kilos.; 100 kilos. of wheat gave 65 kilos. of flour; 100 kilos. of flour make 130 kilos. of bread."

According to these averages, the produce per hectare is as follows:—

Year.	Wheat.	Flour.	Bread.
	Kil.	Kil.	Kil.
1858	2340	1755	2474
1859	1440	1080	1485
1860	1260	819	1064

The same table adapted to English measures will stand thus:—

Produce per Acre.

Year.	Wheat.	Flour.	Bread.
	lbs.	lbs.	lbs.
1858	2096	1572	2217
1859	1290	967	1330
1860	1128	733	953*

The manager, M. Moll, remarks that this fall in the value of the produce, so far from being accompanied by a reduction of expenses, was coincident with unusual difficulties and high rates of payment in the labour market.

In 1859 the supply of extraneous — particularly Belgian — labour failed utterly, and the price of day-labour and task-work rose accordingly. Then came torrents of rain and lodgment of crops, and from these combined influences the price of reaping an acre was 1*l.*, instead of from 10*s.* to 13*s.*; that of cutting and tying an acre of oats 15*s.* and 16*s.*, instead of from 6*s.* 6*d.* to 9*s.* 6*d.*†

* In this and the following tables the French hectare is taken approximately as equal to 2½ English acres, instead of 2A. 1R. 35P., its exact area. The kilogramme is represented correctly as 2·24 lbs. avoir. The results thus obtained are sufficiently correct, and the labour of remodelling these tables is still considerable. —P. H. F.

† The environs of Paris are generally ill-supplied with labour, because in that city wages are high and living cheap. Vaujours has a further drawback, from the influence of the neighbouring cement-works which draw away the men, and the glove-trade which employs the women. Field culture by hand-labour would be almost impracticable but for the influx of Belgian, Burgundian, Norman, and Alsatian workmen. To procure labourers without paying the rates of the cement-works, efforts were made to protect them from being pillaged by publicans. After

Last, but not least of evils, come the rabbits, which are charged in the balance-sheet with damage amounting to 128*l.*; that is to say, three times the amount of rates and taxes, and nearly half the rent, although account is only taken of the principal crops which were injured.

Lodgment of Crops.

The chief disasters met with at Vaujours arose from the lodgment of the crops, which called forth the following observations from the manager:—

Whilst, on the one hand, agricultural profit hinges on growing a maximum crop, a lodged crop is a certain loss. It is, therefore, important but difficult to hit the mean of bulk.

The limit is very variable. Whilst in the rich alluvial lands of Norsig-le-See from 55 to 60 bushels of wheat per acre may be grown without danger from lodging, elsewhere the corn is prostrate so that the weeds grow through it, and the yield is destroyed if an attempt be made by manuring to exceed a crop of from 22 to 28 bushels.

Fresh and highly nitrogenous manure adapted for immediate assimilation promotes this lodgment. This remark applies to sewage.

From experience of such effects at the Central Reservoir, as well as at Vaujours, it was determined almost to abandon the growth of wheat. But, unhappily, oats, which were necessary for home use, also lodged; and if they did not suffer equally in the grain, the cost of harvesting was greatly increased. This drawback has been diminished, but not removed, by growing foreign varieties of seed.

But, with us, in 1860, the mischief did not stop here. Even the crops of rape and rye-grass, forced on by copious dressings of sewage applied in winter by the pipes, developed extraordinary foliage, and ended by being lodged. This happened especially on poor lands highly manured in winter.

If the rye-grass be nearly fit for the scythe before it is lodged, the damage is not great, though cutting will then cost more; but when the mischief takes place at an early stage of growth, the loss is serious. The grass will rot as it stands, if not cut directly; and, even then, it is hard to make, shrinks in drying, and assumes a bad colour—in fact, it must be consumed as green fodder.

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the example of the Imperial farms and large German establishments, a purveyor was put into a cantine, under a contract to board both day-labourers and men doing task-work at a given rate. Nevertheless, the growth of crops requiring much hand-labour has been necessarily abandoned, and task-work has been substituted for day-work when possible, and machinery introduced. The hay-maker and horse-rake are already in use, the mower and reaper in contemplation.

No agricultural treatise, to my knowledge, speaks of forage-crops being lodged; but the report of the English Commissioners sent in 1859 to Milan notices this remarkable fact—that 4000 acres of meadow irrigated by the waters of the Canal of Vittabia, the main outfall of the sewers of Milan, become so much enriched that every three years, or even every other year, the surface herbage (*la surface inherbée*) is removed, and sold as manure. But for this precaution, the growth would be so rank and luxuriant that the grass would lodge, so that the scythe would not go through it.

At Vaujours a contract had been entered into to use 10,000 tons of sewage yearly; in 1859, 6000 tons had been applied undiluted, the lodgment of forage-crops not having been anticipated. The City of Paris has annulled this contract, wisely considering that its interest is best promoted by the most economical application of its stores of manure, so as to exhibit the best result with the least amount of sewage.

The best precautions against lodging are to apply the manure some time before sowing the crop, and then to give a good deep cultivation. It would seem that "lodging" arises especially from a want of equilibrium between the organic and mineral constituents of the plant; and that this want of equilibrium takes place when the manure has been so recently applied that it has not had time to act chemically on the soil, so as to render the mineral food of plants free, soluble, and capable of assimilation. Top-dressings must consequently be avoided or made very light—say 6 to 8 tons per acre.

With proper attention to these precautions cereals may be grown with sewage. For layers, especially rye-grass layers, these rules should be observed:—

1. As in the case of grain-crops, to apply the sewage some time before sowing, and stir the ground well.

2. To give but a moderate winter dressing. The danger is, that the first crop should lodge; the second and third will bear forcing.

3. To grow lucerne and mixed layers rather than Italian rye-grass.

4. To feed the most luxuriant crops till the middle of April, or even later.

There are certain crops which never lodge, however highly manured, *e. g.*, cabbage, maize, sorghum, hemp, tobacco, and beet. The first requires too much labour to suit Vaujours; the second and third might be serviceable when our dairy is organised. Hemp grows well, but cannot be sold standing; the labour of scutching, &c., makes this crop better adapted to the peasant proprietor than to the large farm.

The Balance-Sheet.

The balance-sheet published in the year 1860 will give a general view of the financial position of enterprise thus far. Its two predecessors had likewise, not unnaturally, shown a deficit for 1857 of 170*l.*; for 1858 of 290*l.*

BALANCE SHEET, 1860.

Assets.	£.	s.	d.
Cash in hand	128	7	0
Various Debtors.			
Banker	124	3	0
Shares not taken up	68	0	0
Various Debtors for Goods supplied	259	14	0
Stock	680	16	0
"Plant" for Irrigation ..	152	17	0
Dead Stock	421	11	0
Underground Pipes	1263	12	0
Growing Crops	961	5	0
Crops in hand	515	12	0
Improvements, Manures, &c.	753	10	0
Correction from last Year's Account	217	12	0
Balance	451	1	0
Odd pence omitted in English statement	0	5	0
	£5999	5	0
Accounts showing a Credit Balance.			
Poultry-yard	6	19	0
Corn in Granary	24	18	0
Dead Stock	17	7	0
Straw in hand	56	6	0
Rye-grass	19	0	0
Dairy	12	4	0
M. Huimy	0	5	0
Correction in Account 1859*	217	14	0
Balance	451	1	0
	£805	14	0

Debts.	£.	s.	d.
Smith (Landlord)	821	7	0
Moll (Manager)	362	16	0
Due to various Tradesmen, &c. (including Taxes, 42*l.* 3*s.*; Rent of Lands, 24*l.*)	470	18	0
Capital	4344	4	0
	£5999	5	0
Accounts Indebted.			
Winter Oats, 1859	0	2	6
Spring Oats, 1859	88	12	0
Flock	148	6	0
Wheat, 1858..	19	4	0
Wheat, 1859..	208	8	0
Beet	6	4	0
Rape	21	15	0
Sour Kraut	0	3	6
Embankment on Canal ...	14	0	0
Carrots	0	11	0
Cabbage	1	4	0
Turnips..	1	2	0
Green Rye	15	9	0
Lucerne..	30	12	6
Meadows	83	8	0
Potatoes..	8	4	0
Rye, 1859	7	4	0
Pigs	0	15	0
"Dardelle" (?)	0	16	0
Manure	8	8	0
"Halfand"	2	10	6
Horses	9	10	0
Injury from Game and Vermin	128	15	0
	£805	14	0

It appears from the form of this document that each crop is separately charged with rent, labour, seed, &c., and credited with the sum it produces. The fixed charges for drains, irrigation, &c., fall so heavily upon the land, that a crop, unless much above the average, cannot be remunerative. The charge for wear and tear

* This entry refers to some payments made on account of drainage, an outlay which the landlord has undertaken to meet.

and interest on the apparatus for irrigation alone is 200*l.* It appears elsewhere that the horses are charged $3\frac{1}{2}$ centimes per hour, or 2*s.* 2*d.* for a day of $7\frac{1}{2}$ hours.

We shall hardly follow the manager through his explanation of all the items in this account, but will glance at those which have the more prominent interest.

Of the grain crops, it may be observed that before the rise of prices they had been valued at a low rate to the granary account, which is a gainer thereby. The proportion borne by the grain to the straw was unusually small, for 29 acres of wheat gave 20,167 sheaves, and only 729 bushels of corn—25 bushels per acre—or $1\frac{3}{10}$ litres (·28 of a gallon) to a sheave, instead of the usual proportion of from $2\frac{1}{2}$ to 3 litres (·55 to ·66 of a gallon).

On a piece of 3 acres the result of the beet crop is striking. The produce was 35 tons, and still the account shows a loss of more than 2*l.* per acre. The selling price (11*s.* 3*d.* per ton) when they were lifted being thought unsatisfactory, they were valued at that price to the stock, but from subsequent mismanagement were spoilt by frost and rain.* The price of labour also told against this crop. Moreover, they were grown with farmyard manure, which was valued at 8 fr. (6*s.* 5*d.*) per ton, and the beet was charged with half that amount.

The loss on the sheep is surprising. It was in great measure caused by disease and death, the soil being so ill-suited to a breeding flock that it has been abandoned. Moreover, the valuation of the flock, though in improved condition, had been lowered; they were set at 18*s.* per head, instead of 22*s.* 6*d.* They were fed on refuse unsaleable stover (probably rye-grass), charged at a high market-price. Half-bred merinos, it is stated, cannot pay on such fare.

The loss on the meadows is not explained in this account. In the two previous years "green crops" had shown a profit of 104*l.*, as was to be expected: for hay, if good, makes a good price at Paris; and if tough or damaged sells fairly for "packing." When the dairy is well organised, this account will probably bear a better aspect.

For the loss on pigs England is in a way responsible; the breed kept, "the New Leicester," is beautiful, but they do not breed.

"Manure" and "Horses" require a word of explanation. The first, taken in the previous year's valuation, had shrunk in bulk, and so was short measure. The horse account suffered

* This account probably belongs to a year subsequent to that in which the exceptional sheep-manure was accumulated.

from losses caused by the severe winter-carting connected with the unhappy new tunnel.

The next item on the debit side is "Vermin,"—that is to say, rabbits.

In justification of this charge a letter is inserted, written by a distinguished French agriculturist—M. Menard de Happemeau—who has carried off the first prize for successful management in his department (Loir-et-Cher).

"By speaking to me of rabbits you open an old wound; I pity you with all my heart, if you have to do with this accursed race. You are indeed in the Forest of Bondy if you are at daggers drawn with sportsmen. These gentlemen think nothing worthy of consideration but game. Rack your brains to cover the sandy wastes of the Sologne with rich harvests; introduce—as you have done—a complete system which will multiply our supply of meat tenfold; sweat blood and water to cheapen the necessaries of life: this is all 'bosh,' in comparison with our noble 'sport,' and yet we are in the nineteenth century!

"You are in a position to make yourself heard: demand then the repeal of the law of 1844, which leaves the farmer at the mercy of game and sportsmen—it is your only chance. For my part, the game has in four years damaged my crops to the amount of 2400*l.* I took legal proceedings against the proprietor, and succeeded before the magistrates, on an appeal, and in the superior court. For one year's damages I received nearly 400*l.*—half my loss; but I find going to law a bad occupation for a farmer, who meanwhile neglects his business, and have come to the heroic determination to enclose 250 acres with close paling, and lay the rest of my farm under grass, which is least injured by game.

"Now, it is full occupation for one man, from October to May, to guard daily my five miles of fence, and stop the gaps which the rabbits make, either by burrowing or gnawing the fence. You see then that I have not got the rabbits down, as you supposed, but have been satisfied with fortifying myself against these invaders at an enormous cost; but I feel daily more and more satisfaction at having adopted this defence."

M. Moll remarks that, being unable to adopt M. Menard's safeguard, and having assured himself that no crop, except hemp, is safe from rabbits, nothing remains for him but to appeal to superior authorities for the right of defending his crops by night or by day against these invaders—a right which the law of 1844 has extinguished.

The profit of the poultry-yard seems to indicate that foxes do not prevail among the "*animaux nuisibles.*" It is a small item, and the profit is probably limited by the amount of tail-corn produced.

The gain on corn and straw in store in reality is due to a rise in price; but the latter is suggestive of a probable source of profit to be derived from the Paris market, when a threshing-machine is procured that does not bruise the straw.

The really promising feature is the dairy. The profit here realised is not large, because the dairy had been but lately organised, and that on the most economical plan. The common

price for a cow at Paris, 20*l.* to 24*l.*, being considered excessive, 8 cows were bought from the Loiret at 6*l.* a head, and 8 heifers from the Haute Saône, and 4 or 5 more picked up at home.

Of course, several among this scratch-lot proved sickly and bad milkers; and when the supply of milk increased, a market for it had to be provided, and, meanwhile, a Swiss cowman was drawing his 32 f. per month for wages. So much for making a start! but that is now done.

The milk produced is rich, and highly approved by consumers. This result is attributed to the excellence of the crops grown by irrigation. It sells wholesale at 1¾*d.*, and retail at 2*d.* per quart (17·5 c. and 20 c. per litre). If any remains unsold, it is made into cheese. This milk yielded 15 to 16 per cent. of cream, which sold at 13*d.* per quart. Three litres of cream, about 2½ quarts, usually give 1 kil. (2⅕ lbs.) of butter—5 per cent. from the milk—a satisfactory result.

Returns are promised in future reports of the proportions subsisting between food consumed and milk furnished by cows of four different races.

A slight but graceful allusion explains the success of the dairy—Madame Moll devotes herself to this, the lady's department. Any careful reader of Professor Voelcker's practical writings on the dairy and its products cannot but be awake to the importance of such co-operation.

Experiments.

The manager, M. Moll, prefaces his Report of Experiments conducted on the farm in various seasons, with remarks to the following effect:—

"To combine experimental agriculture with profit is indisputably the hardest problem in farming; but the manager of Vaujours is pledged to attempt its solution.

"The main object of these trials was simple enough—to prove the efficacy of Parisian night-soil; but in a complex art like agriculture nothing is simple, especially no comparative experiments which aim at obtaining scientific accuracy—a result not easily reconcilable with the ordinary routine of labour.

"Experiments on a small scale—pocket-handkerchief farming—have been severely, and in part justly, criticised. Under the influence of this criticism field-experiments were commenced, which are simple enough if it is sufficient to ascertain that the crop on such a plot is somewhat better than another, or the reverse; but beset with difficulties if the excess or deficit is to be ascertained by weighing—a troublesome task even in fair weather, and still more so when seasons are unfavourable and hands scarce. Moreover, for a comparative experiment to have

any real value, it is indispensable that every other circumstance connected with the plots, except the special object of trial, should be identical; that is, that not only the soil should be uniform, but that the ploughing, harrowing, manuring, and sowing be done simultaneously, since the difference of even a few hours may tell seriously on the results.

"These considerations will account for the small number of experiments made, or at least reported, by the most enlightened advocates of agricultural improvement, and for their disregard of such experiments as have not been verified by repeated trials."

The experiments commenced in the dry years 1857 and 1858, before the pumps and pipes were in operation, and before a supply of water for dilution had been secured, were in many respects inconclusive, and in some, unsatisfactory.

Potatoes irrigated at the end of June in a scorching season, with undiluted sewage, were injured by the dressing. The plants were burnt up, and after a few days the leaves and small branches fell off; new shoots sprang up from below, new tubers were formed, and the older ones died away. The two succeeding crops of wheat and oats, however, profited largely by this misapplied dressing. Even on mangold, sewage undiluted did not produce a favourable effect in a hot season.

For corn-crops the lesson was learnt that to avoid "lodging," an application of the sewage, some time before sowing, is desirable, a top-dressing in spring being fatal in a wet season. On the other hand, the application of sewage to first and second-crop hay gave the following satisfactory results.

The Effect of Sewage on the Hay-Crop—chiefly Rye-Grass.

	Green Produce.		Hay.		Percentage of Nitrogen in Hay.
	tons.	cwts.	tons.	cwts.	
A First Cutting, May 9th:—					
Hay dressed in winter with 10 tons (nearly) of sewage per acre	9	4	2	4	1·94
Hay on same field not dressed	3	0	0	$14\frac{2}{3}$	1·20
A Second Cutting, September 11th:—					
Aftermath dressed with 18 tons per acre..	6	10	1	$6\frac{2}{5}$	2·90
Aftermath not dressed	0	$8\frac{2}{5}$	0	$2\frac{1}{6}$	1·60

The whole field had been dressed with sewage before the seed was sown; but for this, the difference in the results would have been still greater.

To complete the experiment M. Houzeau was requested, for the purpose of comparison with our own product, to analyse the hay of Paimbœuf, which is in high repute at Nantes, and that of

La Guerche, a first-class hay in the Paris market. The results were as follows:—

	Hay from Paimbœuf.	Hay from La Guerche.
Water	12·55	11·95
Phosphates and other mineral salts	7·75	6·68
Woody fibre and cellulose	24·50	26·90
Saccharine and starchy matter, &c.	46·23	45·73
Albuminous substances	7·12	6·94
Fatty matter	1·85	1·80
	100·00	100·00
Nitrogen	1·44	1·11

In these analyses, M. Moll remarks, "I will only call attention to the nitrogen which they severally contain. The nitrogen in the highly-esteemed hay of La Guerche appears to amount only to 57 per cent. of that contained in our first piece, and 38 per cent. of the third piece; nevertheless stock are very fond of this hay, and it seems to suit them well.

"Are, then, chemists mistaken in pointing out nitrogen as one of the most important elements of nutrition? I think not; but only believe that rye-grass—the chief constituent in our hay—either is a substance unpalatable to stock, or that it has properties unfavourable to mastication. The latter hypothesis is probably the true one; a man need only look at its limp but likewise tough and harsh stems, to understand why stock do not like it."

In conclusion, M. Moll remarks on the economical result, that though the dressing was applied undiluted—a most objectionable proceeding in summer, particularly such a dry, hot summer as 1858—each ton of the dressing produced an increase of 2 cwt. of hay. Since, then, each ton cost, everything included, 2*s.*, and the 2 cwt. of hay were worth from 4*s.* 2*d.* to 5*s.*, the gain was clear, particularly if the manifest effect of the dressing on the crops of the next year be taken into account.

This experiment and these observations will be read with interest by those who can recall to mind Professor Voelcker's remarks, in connexion with his lecture on Sewage, to the effect that an excess of nitrogen in a crop rather indicated want of maturity than a higher feeding value.

An experiment intended to contrast the effects of farmyard manure, of "soil," and of rape-cake, on the growth of oats, brought out one or two remarkable facts. It was intended to furnish to each plot, under a different form, an equal quantity of nitrogen; but the yard manure applied was that made by sheep, wintered chiefly upon hay, and littered with straw, and it was rather hastily assumed that it would have the same composition as ordinary farmyard manure: but that there might be no uncer-

tainty, it was submitted to M. Houzeau for analysis, when the mistake was discovered, but could not easily be rectified. The analysis was as follows:—

Analysis of Manure made by Sheep wintered upon Hay, and littered with Straw in a Yard.

Organic matter and ammoniacal salts	28·960
Carbonic acid of combination	0·512
Phosphoric acid	1·285
Sulphuric acid	1·277
Chlorine	0·916
Potassium	0·611
Sodium	1·222
Magnesia and oxide of iron	0·256
Lime	2·087
Clay, sand, and soluble silica	12·194
Water	50·680
	100·000

Nitrogen, as carbonate of ammonia	·072
,, in other salts	·201
,, in organic matter	·922
,, in nitrates	traces
	1·195

The small amount of water (50 per cent., instead of 75-80) and the large proportion of nitrogen (1·195, instead of 0·400) which this manure contained, quite deranged the intended balance between the experimental manures. Since the "soil" contained of nitrogen 0·350 per cent., and of minerals and salts left after combustion 0·843 per cent., it had been intended that a dressing of 24 tons per acre of yard manure, and the same number of tons of soil, should be applied. When the result of the analysis became known, to make up for the existing inequality, a farther supply of 24 tons per acre of sewage, diluted with an equal bulk of water, was applied as a top-dressing to the growing crop. The result was not so favourable as the manager anticipated, but it perhaps did all that he had any right to expect from this overdose. But even then more nitrogen had been supplied in the yard manure than in the sewage: viz., in the first, at the rate of 642 lbs. per acre, and in the second only 376 lbs. One experimental plot then had 120 tons of sewage; another, apparently 60 tons of sewage; another, 1 ton 11 cwt. of rape-cake, which was thought equal to 19 tons per acre of common yard manure; but more could not be procured.

The sowing of the oats was delayed till the 7th of May. A rainy season set in before the top-dressing of 24 tons was given, June 9th, to the 2nd plot. Great heat followed; the crops ripened unequally. The unmanured plot and that manured with

rape-cake ripened well; that with farmyard-manures less well; those dressed with sewage were worst in this respect. After an unsatisfactory harvest the crop was tied and weighed, September 19th. No account was kept of the produce of grain. The weight of straw and grain together was as follows:—

	Tons.	cwts.	
Plot 1. Yard manure	1	$2\frac{2}{5}$	per acre.
,, 2. Sewage	1	$2\frac{1}{5}$	,,
,, 3. Rape-cake	0	16	,,
,, 4. Nothing	0	9	,,

It is needless to criticise these results. Moderate, rational, and seasonable manuring can alone furnish a good practical lesson; but incidentally we owe to this record a useful analysis of a peculiar sort of manure.

The Effects of a Manure, contrasted with the Manurial Effects produced by the Food and Litter which are consumed to furnish such Manure.

The next experiment recorded was also rather serviceable in design, than successful in the event.

The manager thus explains his motives for instituting this comparison: "It has been said that stock does not so much make, as consume manure, and common sense shows that the animal cannot live, grow, or fatten but by retaining and assimilating a portion of the food which it devours; and yet, whenever these constituents of manure have been applied to the soil instead of the manure itself, less produce has been reaped than would have been looked for if the substances employed had passed through the animal economy. This seems to be a paradox; but may we not suppose that if, on the one hand, these substances have parted with some of their fertilising elements, on the other hand they have been so affected by the digestive process that when they have been piled up in heaps, or buried in the soil, they act powerfully on the atmospheric gases, absorbing, condensing, and assimilating these sources of fertility,—in short, playing the part of natural nitre-beds, with greater efficacy than they could have done in their primary state? At all events, this is an open question. Theory appears to be at variance with fact, whilst reputed facts have not been watched with the care and exactitude required for their establishment as conclusive."

The following experiment was therefore undertaken with a view to supplying this apparent defect. Two plots (5 and 6), adjacent to the four referred to in the last experiment, were manured: the latter, No. 6, with 60 tons of manure; and No. 5 with 8 tons of hay and 2 tons 16 cwt. of straw per acre. These 10 tons 16 cwt. of food and litter would, in fact, have made $2\frac{1}{4}$ times that amount of manure, or 24 tons 6 cwt. But

the hay used—the aftercrop, similar to that referred to in a previous experiment, containing 2·9 per cent. of nitrogen, supplied in all 519 lbs. of nitrogen, to which that in the straw—estimated at 0·5 per cent.—added 31 lbs. more, or 550 lbs. in all, instead of the 642 lbs. of nitrogen contained in the dung. The inequality was not as great as in the preceding experiment. The result was that—

	Cwts.	lbs.
Plot No. 5, dressed with dung, produced	18	74
,, No. 6, manured with chopped straw and hay, produced	18	58

or very nearly an equal bulk.

An Experiment to compare the Effect produced by a given quantity of ordinary Manure: 1st. When applied in the usual manner; 2ndly. When converted into Liquid Manure.

"This was a subject of special interest to the farm at Vaujours, besides having been much debated elsewhere. The advocates of liquid manure, on the one hand, had maintained that the action of manure is quadrupled by dilution; its opponents put into the mouth of an eminent agriculturist a statement (which he did not confirm) that the fæces of 48 cows, distributed over 25 acres in a liquid form, were of little use, except for dissolving the guano which he also applied." To test these contending assertions, two plots, 7 and 8, adjoining the previous six, were manured at the rate of 24 tons per acre. To No. 8 the manure was applied in the usual manner; with No. 7 this course was adopted:—The manure was mixed with $3\frac{1}{3}$ times its weight of water 36 hours before use; it was then well stirred and macerated over-night. The solid matter (remains of straw and hay) was then strained off, and one-half of the liquid applied to the land and hoed in at once, at the same time that No. 8 was manured, the other half being kept in reserve.

Both plots were sown with Indian corn, broadcast, on the 18th of May; and on the 9th of June, after a showery interval, the other half of the liquid manure was applied to No. 7, the Indian corn being then well up and strong. To the end of June—the weather being then damp—no difference was perceptible between the plots; after that, in the hot months of July and August, No. 7 showed a decided advantage. On the 7th of September the crops on each piece were cut with the sickle and set into stooks, where they remained till October 17th, when both were weighed.

The climate of Vaujours being unsuited for the ripening of this grain, account could only be taken of the gross weight, which was—

Produce of Maize.

	Tons.	cwts.	lbs.
On Plot 7. Manure applied in liquid form, 24 tons per acre	8	11	11
,, Plot 8. Manure applied in the ordinary manner	6	8	100

or, in other words, the produce of Plot 7 was nearly one-third greater than that of Plot 8.

In 1860,—a year, be it remembered, which was cold and wet, almost beyond precedent,—the eight plots referred to in the preceding experiments were all sown with giant wheat on the 15th of November; it was ripe, and cut August the 28th; was carted on the 6th of September; and on the 17th the corn and straw were carefully measured and weighed.

The results are given in the following table:—

Plots.	Quantity of Manure per Acre applied in 1859.	Crop of Oats, 1859.	Crop of Giant Wheat, 1860, per Acre. Produce in Grain.	Produce in Straw.	Proportion between the Grain and Straw.
		Tons. cwts. lbs.	lbs.	Tons. cwts. lbs.	
1	Sheep-manure, 24 tons = 48 tons of common farmyard-manure	1 2 44	1505	2 12 62	0·256
2	Sewage, 48 tons	1 2 22	1701	2 10 44	0·302
3	Rape-cake, 1 ton 11 cwts.	0 16 0	964	1 17 15	0·256
4	Nothing	0 9 0	808	1 8 9	0·257
5	Sheep-manure, 24 tons = 48 tons	0 18 74	1680	2 11 44	0·291
6	Hay, 8 tons; straw, 2 tons 16 cwts.	0 18 58	1350	2 1 71	0·290
		Crop of Maize, Stalks and Corn.			
7	Sheep-manure (= 48 tons) converted into liquid-manure ..	8 11 11	1510	2 9 61	0·272
8	Sheep-manure (= 48 tons)	6 8 100	1688	2 11 35	0·294

It is remarkable that the sewage when applied in these large quantities acted more favourably on the second than on the first crop, and, as compared with farmyard manure, increased the grain more than the straw, producing 5 per cent. less straw and 13 per cent. more grain than the latter.

In plot 6 the chopped hay and straw used as manure is comparatively still less successful than in the preceding year. This result is contrary to the received opinion, which assigns to vegetable manures a less energetic but more abiding action than that of animal manure.

In plot 7 the yard-manure applied in a liquid shape is much behind its competitor in plot 8, producing 25 bushels of corn as against 28 bushels, and 2 tons $9\frac{1}{2}$ cwts. of straw as against 2 tons $11\frac{1}{3}$ cwts., but in the preceding year it had an excess of one-third.

But the enlightened advocates of liquid manure have always admitted its want of endurance, which, however, is no real defect. A prompt return and rapid circulation of capital is the chief object to be attained; if from one process and one crop a full and immediate return can be reaped for every outlay, then

that feature in agriculture will have been removed which contrasts most unfavourably with the returns derived from trade and commerce. In 1861 these plots were all in Dutch clover; in 1862 a wheat crop will again be taken, to complete the series of experiments. These will be the subject of future reports.

The Comparative Effect of Farmyard Manure and Sewage on Mangold.

The object here was to compare the crop produced by farmyard manure with that resulting from a single dressing of sewage, from two such dressings, and from two dressings of liquid in addition to farmyard manure.

The soil was a clayey loam with a subsoil of clay or marl; it had last grown lucerne, which was prematurely smothered with grass.

The first lot had manure from the sheep-yards, such as has been before referred to, but in this case it contained 70 per cent. of water. This was laid on in March. This and the two next plots were ploughed at the end of April or early in May, and sown about May the 15th.

The fourth plot had been manured like the first, but ploughed in February; it was then harrowed, scarified, and rolled before the sowing, which took place about May the 15th. The manure applied at the rate of 33 tons 10 cwts. per acre was equivalent to 34 tons 16 cwts. per acre of ordinary manure, as it contained 5 per cent. less water than is usual. The first dressing of liquid was applied June the 9th, viz. 8 tons of sewage diluted with 32 tons of water per acre.

The second dressing, given towards the end of June, consisted of 3 tons 3 cwts. of sewage with 6 tons 8 cwts. of water.

The plots were weighed in the field eight days after they were pulled and laid in small heaps: they had been cleaned with more than common attention, so that the distillery of Mitry, which bought them, only deducted 3 per cent. from the gross weight for tare, &c. The produce was as follows:—

Plots.	Mangold Crop.	Weight of Roots and Leaves per Acre.		Weight of Roots topped and tailed, per Acre.		Number of Roots per Cwt.
		tons.	cwts.	tons.	cwts.	
1	Yard manure, 34 tons 16 cwts.	28	10	24	17	30½
2	1 dressing of sewage, 8 tons 3 cwts. ..	35	6	26	11	29
3	2 dressings, in all 11 tons 6 cwts.	37	18	32	15	23½
4	Yard manure, as Plot 1; liquid manure, as Plot 3	55	17	48	8	18½

These experiments show the special advantage of using liquid

manure for roots, and the importance of diluting it when applied to growing crops. The yield increases in the following proportions: 100 : 107 ; 132 : 183.

If the farmyard manure be valued at 6*s.* 5*d.* per ton, including all costs, and 3*s.* 2*d.* be charged for each ton of liquid manure, when applied to the land together with the water with which it was diluted, it appears that the yard manure in plot 1 constitutes a charge against the roots of 4*s.* 6*d.* per ton ; the sewage in plot 2 a charge of 1*s.* ; that in plot 3 of 1*s.* 1½*d.* ; and, lastly, manure and sewage together in plot 4 make a charge of 3*s.* 4*d.* per ton.

It must not be concluded from this, remarks M. Moll, that there is any benefit in restricting the supply of manure, because other outgoings, such as rent, taxes, tillage, seed, hoeing, are chargeable upon the land, whether the crop be larger or smaller. I have no doubt that, all costs being included, the crop on plot 3 was more economically grown than that on plot 2.

The conclusions to be arrived at from these and similar experiments, so far as they can at present be drawn, are thus summed up by the manager, M. Moll, after remarking on the difficulties he had to contend with, from unfavourable seasons, the incomplete state of his apparatus, and the want (now removed) of a supply of water for purposes of dilution.

1. Night-soil alone, applied to crops in full growth during dry weather in summer, is always more or less injurious.

2. It is generally of service when applied during rain in summer, but its action depends much upon the amount of rain during and after the dressing, the nature and state of forwardness of the crop, and the greater or less permeability of the soil.

3. Applied during drought to pastures newly mown, it produces little or no effect until the first heavy rain.

4. If it be spread on bare ground shortly before sowing, it appears to be equal in immediate effect to a similar weight of good farmyard manure; and, applied in considerable quantities (say 32 to 48 tons an acre) and on clay soils, the effects will be apparent for two or even three years.

5. Since, however, weight for weight, it contains less nitrogen than farmyard manure (·35 instead of ·597 per cent.), it follows that 59 lbs. of nitrogen in night-soil will produce as much effect as 100 lbs. in farmyard manure.

6. The most efficacious mode of application is to mix "soil" with from three to five times its bulk of water, and apply it in spring to *young* plants.

7. Applied in the above form to beetroot, it produced 26 tons 11 cwts. of clean roots per acre from a supply of 63 lbs. of nitrogen; whereas common manure, containing 448 lbs. of nitrogen, only gave 24 tons 17 cwts. In the first instance each pound of

nitrogen produced 935 lbs. of beet, and in the second only 124 lbs.

8. It is, however, probable that the virtue of the night-soil is then wholly absorbed, whilst it is generally admitted that only one-half of that contained in ordinary manure is consumed by a crop of beet. The relation, therefore, between the two manures would not be as 935 to 124, but rather as 935 to 248.

9. It must be added that the quantity of vegetable matter already in the soil (the previous crop of lucerne having been ploughed in) and the wet season had probably aided the action of the night-soil, more than that of the other manure.

10. Night-soil does not act on all other plants to such a remarkable degree as on beet. The experiments made near the "reservoir" would lead to the following classification in their order of adaptation :—

1. Beetroot, turnips, swedes, carrots, and cabbages.
2. Hemp and rape.
3. Green forage-crops, especially Italian rye-grass ; maize, and sorghum.
4. Cereals.
5. Potatoes, Jerusalem artichokes, leguminous green crops.
6. Pulse crops.

11. For all these plants night-soil diluted with water is much superior both to farmyard manure, and to pure night-soil, howsoever this last may be applied.

12. The decided superiority of the "tubular system" over the barrel and scoop is a necessary consequence of the great superiority of diluted over pure night-soil. In an economical point of view, the latter mode is out of the question if the bulk of the dressing is to be increased fourfold.

13. A serious objection to night-soil as manure for the grasses generally, and the cereals in particular, or even for rape, is, that when applied in considerable quantities (from 12 to 20 tons per acre), it produces rank vegetation, which in a rainy season leads to the crop being lodged.

14. On the other hand, it seems largely to increase the amount of nitrogen and minerals contained in green crops, and there is every reason to believe that it exercises a like influence on other plants.

15. Farmyard manure, when applied in a liquid form, and contrasted with the same amount laid on in the usual manner, showed itself far superior the first year, and but little inferior in the second.

In conclusion, it may be stated that the series of experiments will be continued and tested by others, designed to *check* or confirm the inferences already drawn.

Plan for Future Cropping.

The chief object of the farm is to grow produce for sale at the market without reference to the production of manure, so that stock is kept only for exceptional cases—for crops that must be eaten green, straw that the machine has bruised, or hay that has lost its colour.

It had been designed to appropriate a large part of the farm to the growth of hay, because the system of irrigation was well suited to this crop; because, the produce being bulky, competition from distant regions was not to be apprehended; and because the labour required for its management was not excessive. But unforeseen difficulties arose. The damp of the climate and the prevalence of fogs were specially detrimental to second and third cuttings; whilst the first crop grown by irrigation was coarse and ill-suited to the market, in spite of the richness of its chemical constituents. Moreover, the direct sale of hay at the Paris market, though far more profitable, was found to be attended with "peculiarities not to the taste of a conscientious man." In but few trades, writes M. Moll, is there so much trickery as in the sale of hay. "To shirt" hay—that is, to wrap up an inferior quality in prime hay—is such a common practice in the neighbourhood of Paris, that he who does not comply with the custom will meet with a bad sale, or none at all. On the other hand, the real consumer, the horse, is not taken into council; his attendant acts as interpreter, and, unhappily, often mistakes his own interest for his client's, and thinks all forage good which is accompanied by a gratuity, and none else. If a sale be made to a dealer, the terms are less favourable, and the payment less certain. Moreover, the labour required must be very promptly provided, and that at the busiest season of the year. Hay, then, is to be made within but moderate bounds. If the rye-grass hay be not very succulent, it may be sold in Paris for packing.

The position of the farm not being favourable for sheep-feeding, dairy-cows will be kept to consume such produce as can best be used when green upon the premises.

Among the crops which will bear the application of rich manure, tobacco suggested itself; but this crop, when grown with liquid manure, though fine in appearance, will not "smoke," and is only fit for snuff; besides, the labour required is costly, and the exciseman vexatious. Its growth was abandoned.

Another crop, suited to irrigation and not expensive as to labour, is hemp. Experiments have shown that with liquid manure it will grow admirably on a rye-stubble without ploughing or costly tillage, and that it has attained a height of 7 feet 9 inches; but then an outlet for this produce must be secured.

Flax, for which there is a market, requires much more labour, and does not like strong dressings of manure.

Cabbage is another crop which suggests itself. The kind made into saurkraut may be cultivated with advantage, it being capable of bearing any quantity of manure. The rabbits are its great enemies; but string covered with "*glu marine*" stretched in two lines, at 4 and 7¾ inches from the ground, round the cabbage-bed, is reported to have protected the plants, with the aid of a few discharges from a gun night and morning; but an appeal to the law of 1844 barred the use of the latter, the more efficacious defence.

To market-gardening the want of hands, the competition of the rich plain of Vertus, and the uncertainty of the market, are obstacles. The vegetable market at Paris is cheaper than in the environs.

As to mangold, it is stated that, though the produce was fair in 1859 and good in 1860, still the crop was in both cases grown at a loss. At the existing price of alcohol, there was a prospect of making nearly 13*s.* per ton, besides receiving back in pulp 60 per cent. of the weight delivered; and these terms are considered remunerative.

A little spring rape for seed, some few acres of corn, and flax grown on a small scale, will complete the programme for future cropping.

Conclusion.

We will now take leave of this French Experimental Farm, with the hope that on some future occasion we may be enabled to record, not only its further contributions to scientific agriculture, but its financial prosperity. If the fixed charges on the land for drainage and irrigation press heavily on the account, the latter, at least, will, in a few years, clear itself, in consequence of the liberal allowance made for depreciation. The proximity to Paris, the great extension of that city, the influence of railways on its environs, are promising features in this undertaking; so that, when the management has thoroughly recognised, and adjusted itself to its position, a profit may be looked for.

The difficulty of reconciling experimental and scientific farming with profit has been referred to by the manager of Vaujours. If any English, Irish, or Scotch agricultural establishment can give proof that it has both acted as a pioneer for science, and likewise realised a gain, any statement to that effect will be welcomed by this Journal as a matter of congratulation to the world at large. If any single farmer, whose occupation is remunerative, can point to similar experiments and show as clear accounts as these, his name will be enrolled in the

annals of agriculture. Meanwhile, our respectful acknowledgments are due for honest reports of efforts made in this direction; and if hitherto losses have been incurred, whether from inexperience, or from over-luxuriant crops having been smitten down by storms, we may hope that ultimately this spirited exponent of the tubular system of irrigation—

> "Per damna, per cædes, ab ipso
> Ducat opes, animumque *ferro*."

XVIII.—*Report on the Employment of Flemish Manure (Night-Soil).* Drawn up for the Municipality of Paris, by a Committee appointed by the Agricultural Society of Lille, in answers to questions put to that Committee by M. HUET, Civil Engineer of the Department "des Ponts et Chaussées." Translated by P. H. FRERE.

1*st Question.*—CAN Flemish manure be employed exclusively—that is to say, Can it entirely take the place of farmyard-manure, rape-cake, &c.?

On small occupations in the neighbourhood of Lille, Flemish manure is often used with profusion, and almost exclusively; but in farms on a larger scale there is rarely an attempt made to fertilise the soil with this alone.

There can be no progressive agriculture without stock, and consequently without straw-manure. If, then, the proprietor makes use of a considerable proportion of this stable-manure, he will do well to apply it in connection with the Flemish, rather than to use the latter on one part of his land, and the former separately on another. On our farms stable-manure is applied to the same soil once in three or four years; each part receives its portion in turn, on the recurrence of certain crops, and the Flemish manure is subsequently applied, either at the same point in the rotation, or the year following, according to circumstances. On strong lands, especially, it would be unreasonable to attempt to found a system of fertilisation upon the exclusive use of night-soil. Farmyard-manure is not only valuable for the saline and nitrogenised matter it contains; it also acts admirably in improving the texture of clay soils. The straw helps to give to the land that porosity without which cultivation would be a delusion; still more, there is no doubt but that the silica which it contains is in a state more favourable for assimilation by the cereals than that of the natural silicates.

From the results of direct experiments we are convinced that

Flemish manure, employed alone, tends to give to the soil a solidity which repeated ploughings would fail to remove.

On a farm in the neighbourhood of Lille it was thought possible to manure the crops entirely with night-soil, two cows only being kept to 100 acres of land. During a few years things went on tolerably well, but it soon became evident that the corn *ran to leaf;* the stems did not attain their proper development, and the yield of corn was extremely deficient. The system was changed, and stock introduced on the farm; from that time farmyard-manure was applied to the land, and soon the corn-crops became equal to those which are generally seen in the Lille district.

The Committee is, then, unanimous in concluding that liquid-manure should not be exclusively used, especially on clay-soils. Management so short-sighted would be liable to bring into discredit this most useful manure, which brings fertility and abundance wherever it is applied with discretion. Nevertheless, on light soils, it may occasionally be used alone, without harm, for a few years, and especially in the cultivation of kitchen-gardens.

2nd Question.—Is Flemish manure suitable to some sorts of land rather than to others?

From what has been just stated it may be concluded that it suits all soils, provided that those which are most heavy receive at proper intervals other indispensable dressings. It will be understood that it is necessary to carry it out into the fields in dry, rather than wet, weather, that the carts may not do injury to the land. The farmer well knows that the porosity of the soil is the first essential to all productive agriculture.

Those of our farmers who make use of Flemish manure always construct near to their fields and on the edges of their roads stone cisterns to serve as reservoirs. These cisterns measure from 1000 to 7000 cubic feet, according to the importance of the farm, and would consequently contain from 30 to 200 tons of water. The manure is brought from the towns when horses are not otherwise occupied, and in rainy weather, when carts cannot be employed in the fields. It is then stored up, and when circumstances are favourable, and the land dry or hardened by frost, it is applied to the soil where required. By thus mixing materials collected in different places, a uniform liquid is obtained of a moderate density, the effect of which can be easily calculated.

We have ascertained by numerous experiments made upon the contents of these cisterns that the specific gravity of Flemish manure, such as is employed in the neighbourhood of Lille, is from 2° to 3° on Beaumé's gauge.

By a singular anomaly, the reservoirs for this manure, as ordinarily constructed in the open fields, are included in the first class of unwholesome works ("*établissements insalubres*"), and as such are subject to formalities and fettered by restrictions which impede their formation. It is desirable that this rigorous law should be modified. Assuredly there is not one enlightened agriculturist—not one man of education—who would dare to maintain that the reservoirs for Flemish manure are sources of unhealthiness. At the worst, they are but a cause of slight annoyance to the passer-by at the moment when their contents are being taken out; but this drawback is clearly not worthy of serious consideration.

3rd Question.—Can Flemish manure be used for all sorts of crops—tobacco, beetroot, corn, rape, flax, artificial grasses?

Flemish manure is used in this district for all sorts of crops with more or less profusion; and in many cases, if carefully managed, it may be applied in large quantities without injuring the quality of the produce.

Tobacco, when grown near towns, is often dressed with an abundant quantity of this manure; nevertheless, the Excise forbid the use of it, because it is supposed that it tends to produce leaves deficient in gum and difficult to dry. It is true that by applying, as was formerly very generally done, a profusion of Flemish manure between the rows of tobacco in full growth, a vigorous impulse is given to the vegetation, which lasts a long time. The leaf subsequently ripens with difficulty, and doubtless absorbs a large quantity of alkaline salts, which render it "hygrometric." * But if, on the contrary, the liquid manure is applied to the soil before the tobacco is transplanted, the leaves will prove of good quality, and the plant shoot vigorously, even though it grow in land long accustomed to this course of treatment. Thus, with the addition of farmyard-manure and rape-cake, about 2900 gallons per acre of this fertiliser may, without inconvenience, be used.† There are, indeed, farmers who claim to have produced good tobacco-crops by applying to the ground destined for the plants as much as from 9000 to 10,000 gallons per acre, besides the farmyard-manure; taking care that three-fourths of the dressing should be applied in

* That is to say, retentive of moisture, and an index of the varying amount of that moisture.

† These figures, as well as those that follow, must only be taken approximately—they necessarily vary according to the value of the manure, which the farmer calculates with more or less exactness, and with the customs belonging to the locality or the particular property. Besides, allowance must always be made for the fertilizing matters which remain in the soil, and whose amount depends on former crops, and the manures applied to them.

winter, and the remaining fourth in spring, before the young plants are put in.

For beetroot, also, the sugar-boilers in general forbid, and rightly, the use of liquid manure, especially if applied in excess. Nevertheless, near Lille, when the beetroot does not succeed tobacco, night-soil is applied, not only before the sowing, but—which is still more injurious to its saccharine properties—after it is up. It is impossible to speak positively as to the quantity used—the farmer is guided in this by his relations with the sugar-manufacturer. If the crop promises to be abundant, it will be his object to improve its saccharine qualities, for fear he should not find sale for it—and then he manures in moderation. If, on the contrary, the plant is thin, and the demand active, he will take the opposite course, and the sugar will be made from vile roots, charged with salts, which sometimes completely prevent the crystallisation of the sugary matter.

In the case of beetroot grown for the stock, the farmer may give free course to his passion for fertilising, and use liquid manure in profusion. This plant is often dressed with a proportion of from 4500 to 5500 gallons per acre, and it is not uncommon thus to obtain a produce of from 32 to 36 tons of roots per acre.

It is, at the same time, acknowledged that a moderate quantity of Flemish manure is not injurious to the saccharine qualities of beetroot intended for sugar—provided always that it be applied to the soil before the crop is sown, and used in the place of a like quantity of rape-cake and farmyard-manure. It may even be said that by this plan the germination of the seed is often made more regular.

The seed of the beet has a very slightly developed perisperm (or kernel). The young plants, on first coming up, can draw but very little nourishment from their mother-store. They are soon obliged to have recourse to the nutritive particles deposited in the soil; and if these are wanting they droop, and fall more or less a prey to insects. If, in the hope of saving the crop, the farmer then applies liquid manure, the plants which remain will acquire an unnatural growth, the roots will be of bad quality, and the crop very defective.

It follows, then, that for plants so constituted it is reasonable to manure before the sowing. There are, besides, many other reasons in favour of the practice.

Wheat, which follows beetroot, is often grown without manure; but if desirable, either in winter or spring, Flemish manure may be applied to give vigour to the more weakly part of the crop. It must be borne in mind that this manure is a most valuable auxiliary to *all* progressive agriculture. As a general rule it is better to apply it before sowing, and with farm-

yard-manure; but in any case, if it happens that a portion of the crop is in danger, it may often be saved by a moderate dressing. We may be sure that, without this auxiliary, agriculture would present many more chances of failure.

For the potato, farmyard-manure is ordinarily applied in winter, and the land watered, before planting, with 1450 gallons of Flemish manure per acre. This last is often used alone on small occupations, either before or after planting, in the proportion of 1700 to 2700 gallons per acre. For this plant, as for beetroot, an excess of liquid-manure is injurious. We obtain bulbs of good quality, solid and succulent, when the night-soil has been applied in moderation before planting, in conjunction with farmyard-manure; and, on the other hand, if Flemish manure be used alone, and spread between the rows of potatoes when in full growth, both quantity and quality will be defective.

As for rape, farmyard-manure is applied at first, and the crop is watered with a proportion of 1450 gallons of liquid manure per acre after planting, either in winter or spring.

For flax, farmyard-manure is almost always used, with about 1450 gallons of Flemish manure. It is advisable to spread this in winter, some time before sowing.

Artificial grasses are watered freely with this manure. On the pastures of La Deule it is certain that, applied in winter or spring, it destroys noxious plants, such as moss, docks, &c., and gives new vigour to the grass.

Turnips, field-cabbages, poppies, gold-of-pleasure, &c., are all likewise manured with night-soil. Turnips generally follow flax; when the latter has had no farmyard-manure, it is applied to the turnips, and they are watered besides with about 1450 gallons of liquid manure per acre. This proportion may be doubled if no farmyard-manure be used. They are sown in July and August. Cabbages require much manure; besides supplies from the farmyard, they receive often from 2500 to 3000 gallons of liquid manure per acre. Stable-manure and about 3000 gallons per acre of night-soil constitute the usual preparation for poppies. A good crop of corn may follow without any further application to the soil. Gold-of-pleasure is sown at the end of the month of May, after the land has been watered with about 1450 gallons of liquid manure per acre.

In the use of Flemish manure the farmer must be guided by the state of the atmosphere. If in winter the weather is wet, it is not desirable to cart over the land; and the application of the manure must be put off to a dry season. There is no profession in which it is so impossible to act on a fixed plan as in agricul-

ture; external circumstances must always modify the intentions of the individual.

4th Question.—To which of these crops can Flemish manure be advantageously applied in the largest quantities?

From what has been said, evidently to tobacco, beetroot (when intended for feed), artificial grasses, rape, cabbages, and potatoes. We must mention also that all through the north of France Flemish manure is used in profusion in the cultivation of kitchen gardens, and yet our vegetables are certainly in no way inferior to those of other countries. Cauliflowers at Dunkerque are watered (*apatelés* *) each with one or two quarts of this manure, and they have a wide reputation under the name of "choux de Rosendael." Our asparagus is as delicate, our green-peas as sweet as elsewhere, although they have assimilated chemical constituents which, from the combinations from which they are derived, inspire a foolish repugnance.

5th Question.—What quantity is it thought most advisable to use in the cultivation of wheat?

As we have already said, it is more common to manure the crop of roots or pulse which precedes the wheat than the wheat itself. If the wheat follow oats, the soil is often dressed with about 1450 gallons of Flemish manure per acre, but this rotation is very rare.

6th Question.—Is it best to use Flemish manure before sowing, or when the plant is up, and then by jet? Which is the most usual practice?

On this head we can only repeat what we have already suggested. The manure must be applied to the soil according to circumstances; but if there be no practical objection, it is best done before sowing. There is no doubt but that the quality of the produce is improved by this means; and, on the other hand, Flemish manure applied to plants in full growth, stimulates their development to an unnatural extent. Wheat tillers and runs to straw, to the injury of the grain; tobacco and beetroot produce rank foliage, and the maturity of the plant is delayed beyond the natural period.

The farmers of the North in general hold the opinion that the land must react upon the manure, and make it undergo certain chemical changes before it will be in a fit state for assimilation

* The market gardeners in the north call a plant "*apatelé*" when a little trench made round its root has been filled with one or two quarts of Flemish manure.

by the plants. This opinion is also that of the most famous of modern agriculturists.

The Agricultural Committee of Lille, feeling a lively interest in the public good, cannot too strongly urge the authorities to take all necessary measures for furthering the use of night-soil in all the rural districts of France. If the great value of this powerful fertiliser be taken into account, the childish prejudice which puts an obstacle to its use cannot be too much deplored.*

Attempts to distribute liquid manure throughout every section of a rural occupation by machinery and pipes are not to be condemned. A considerable outlay at the beginning may often save much subsequent expense in hand-labour; and, besides, the distribution is thus effected in a regular manner and in due season. At the same time, the Committee is of opinion that more may be done towards introducing the general use of night-soil in agriculture by starting after the rough and primitive fashion of Flanders—that is, by conveying it in carts to the fields when the weather is suitable, and spreading it subsequently by means of scoops, or any other simple manner. The farmer unacquainted with the practice of the North would see in this an undertaking quite within his means. If, on the contrary, he imagines that night-soil cannot be made use of without expensive machinery, of which he could never dream of becoming the owner, he will abandon all idea of employing it, to his own loss as well as that of the commonwealth.

XIX.—*On the Wear and Tear of Agricultural Steam-Engines and Threshing Machines, whether Fixed or Portable.*

By Henry Evershed.

In this paper an attempt is made to estimate the cost of repairs and other charges on agricultural steam-engines and threshing machinery. The costs in question vary largely, according to circumstances. We adhere strictly to actual returns and to cases that have come within our own knowledge, selecting specimens of various results—good, bad, or moderate—in the hope that the reader may be able to strike an average applicable to his own case, and to establish a reliable basis for calculations as to the

* Few persons are aware that under the blue sky of Nice the night-soil is carefully collected to serve as manure. Our new countrymen use it for their vines, their orange-trees, their violet-plants, &c., which nevertheless does not hinder their oranges from being delicious. their grapes excellent, and their violets from forming the delight of their "*élégantes*," and the favourite perfume in winter for drawing-rooms and boudoirs.

costs of steam-power, whether used for threshing—which is more especially considered here—or for cultivation.

Repair of Portable Engines.

A 5-horse-power portable steam-engine, belonging to the Right Hon. the Earl of Stradbroke, of Henham Hall, Suffolk, which was used to do the work of the home farm, including threshing and grinding corn, and cutting chaff for a large stud of horses, and for farm stock, cost for repairs as follows:—

1852.							
April 17th.	Cost of 5-horse-power engine, 180*l.*						
1853.		£.	*s.*	*d.*	£.	*s.*	*d.*
Sept. 29th.	Material	0	2	3			
Oct. 28th.	Fire-bars	1	13	4			
					1	15	7
1854.							
March.	Gauge-glass and grummets	0	4	9			
June 19th.	Ditto	0	6	6			
August.	Gun-metal bearing for crank-shaft ..	3	10	0			
November.	Fire-bars	1	11	2			
,,	Back	0	10	2			
					6	2	7
1855.							
February.	Water-gauge and glass, and grummets	0	5	9			
March.	Repairs	10	17	9			
,,	Fire-bars	0	11	4			
					11	14	10
1856.							
September.	*An accident.*						
,,	New smoke-funnel, brasses throughout, new crank, governors repaired ..	26	0	0			
,,	A cast back	0	9	11			
,,	Flue-brushes	0	6	0			
					26	15	11
1858.							
March.	Repairs and bars				10	15	0
	Total cost of repairs in six years				£57	3	11
	Average, 9*l.* 10*s.* 8*d.*						

But it must be further stated that in the following year the engine required a new fire-box and extensive repairs.

An 8-horse power portable steam-engine, belonging to Mr. E. Cottingham, Dunningworth Hall, Suffolk, gave this result:—

1858.							
December.	Cost of 8-horse-power engine, 235*l.*						
1859.		£.	*s.*	*d.*	£.	*s.*	*d.*
February.	Fire-bars	1	0	0			
Nov. 12th.	Flue-brushes	0	6	0			
,,	Water-gauge glasses	0	14	0			
December.	Adjusting brasses	0	19	6			
					2	19	11
	Carried forward				£2	19	11

	Brought forward		£2 19 11
1860.			
February.	Gauge glasses	0 12 6	
April.	Repairs, &c.	2 10 9	
"	Do. exhaust-pipe	1 11 6	
Oct. 6th.	Funnel-joint	0 6 0	
			5 0 9
1861.			
Jan. 1st.	Repairs	6 13 6	
Mar. 30th.	Caulking tubes	0 11 0	
April 18th.	Furnace-bars	0 18 11	
Nov. 26th.	Repairs	8 11 6	
			16 14 11
	Total cost of repairs for three years		£24 15 7
	Average, 8*l*. 5*s*. 2*d*. a-year.		

This engine is used to thresh, cut chaff, and grind corn, on a farm of 1500 acres, nearly all arable, and is used nearly 3 days in a week.

The following are the costs of repairs of an 8-horse-power engine, bought October 20th, 1856, worked about 3 days a week, omitting fire-bars—which have averaged 1*l*. 15*s*. yearly for 8-horse-power engines; and 1*l*. 8*s*. yearly for 7-horse-power engines. This engine is under very excellent management, and belongs to Mr. Willsher, of Petches, near Weathersfield, Essex:—

1857.		£. *s*. *d*.	
August.	Engine looked over, and brasses	0 10 0	
"	Excentric strap broken; new one from Lincoln	1 12 6	
Sept. 10th.	New strap and excentric, with man to fit it up	3 10 0	
			5 12 6
1858.			
January.	13 new ferrules to tubes, and chimney repaired	1 1 0	
"	8 new ferrules, brasses adjusted	0 17 0	
			1 18 0
1859.			
August.	Wheelwright for repairs of engine shafts	0 15 0	
December.	Excentric strap (broken)	1 12 6	
			2 7 6
1860.			
January.	New ferrules in tubes	2 14 0	
April.	Patch put to fire-box, and two new stay-bolts	4 0 0	
			6 14 0
"	Fire-bars		7 0 0
			£23 12 0

1860.
Midsummer. New fire-box and new tubes, smoke-box repaired, &c., 45*l*.

The fire-box of this engine lasted a much less time than usual; the cost of repairs up to the time of its renewal was 5*l.* 18*s.* a year.

We have selected these detailed statements of the costs of repairs from a great many similar ones lying before us, and which we omit, as they would only crowd the pages of the Journal without giving any additional information. We have returns of the cost of repairs of at least 20 portable engines, varying in amount from 4*l.* to 14*l.* yearly for an 8-horse engine, exclusive of the cost of new fire-boxes. When so much depends, not only on the amount of work done, the quality of the water used, the care and intelligence of the engineer, but also on the inherent difference existing between two engines turned out of the same workshop, it is not easy to make an average estimate of the cost of their repairs.

By far the most costly item in this account is the renewal of the fire-box, which, with carriage, will cost from 35*l.* to 45*l.*; and there is no surer test of the treatment which the engine has received, than the early and repeated recurrence of this demand. I am informed by a friend that his engine—now in its fourth year of use—already requires a new fire-box, although it has worked but once a week, and been supplied with soft water. My friend, however, is not surprised at this, because he has left the engine entirely in the hands of a farm labourer.

An eminent maker informs me that with good management the fire-box of a portable engine used 2 days a week will last at least 7 years. Several instances of its lasting 10 or 11 years, when used twice a week, have come within my own knowledge.

To show how much this outlay may be diminished if an engine be well attended to and protected from dust and damp, I give the following extract of a letter received from the owners of a 5-horse-power portable steam-engine, used in an adjoining silk-mill, and kept constantly under the care of skilled mechanics:—"The engine was worked in the mills about 6½ years, and about 2 days in the week during the whole of that period. The repairs done to it were not extensive. The tubes at the fire-ends were once caulked round to stop leakages, and afterwards 8 new tubes and 2 new collars were put in, the cost of the whole of which was about 8*l.*" This statement does not pretend to include every item of repairs; but after 6½ years there was no sign of injury to the fire-box of this engine, showing how much the outlay depends on good treatment and favourable circumstances.

Repairs of Fixed Engines.

The following were the repairs done to an overhead 10-horse-power fixed steam-engine, fitted with extra large boiler for burning wood, in 1853, belonging to the Right Hon. the Earl of Stradbroke; price, not including fixing, 350*l.*:—

		£. s. d.	£. s. d.
1854.			
Jan. 30th.	Repairs	0 15 0	
July 15th.	Adjusting engine-slides	0 13 6	
„	Water-gauge glass and grummets ..	0 4 9	
August.	Excentric band repaired	0 10 6	
„	Furnace-bars	1 4 0	
			3 7 9
1855.			
March.	Repairs	5 3 6	
December.	Bars and new back	2 17 0	
„	Screws, &c.	0 5 6	
			9 6 0
1856.—Nothing.			
1857.			
March.	A cast back to furnace and bars	1 10 6	
April.	Piston taken out and repaired	3 15 0	
			5 5 6
1858.	Bars		1 10 9
1859.—Nothing.			
1860.—Same.			
1861.			
July.	Repairs to piston, &c.		4 7 0
	2*l.* 19*s.* 7*d.* per annum for eight years.		£23 17 0

This is the only *detailed* estimate we possess, and the gross sum happens to be heavier than in any other return. On the whole we believe that 3*l.* per annum for the first ten years will cover the cost of repairs of an eight or ten horse fixed engine, well managed, and used as often as it is likely to be required on any large farm. At the end of that period the cylinder will probably require re-boring, and a general repair of the engine and boiler will be needed, at a cost of about 40*l.*

In order to estimate the proper charge for repairs and depreciation we must know how long the engine will last. Supposing the process of repair to be repeated, it is difficult to assign a limit to the duration of a well-made engine, simple in all its parts as a non-condensing engine is now made. We shall, however, for purposes of calculation, suppose that at thirty years old an eight-horse engine is worth 50*l.* with its fixing, and that besides the outlay of 3*l.* a year for lesser repairs it has in its tenth and twentieth years received a thorough repair, as before referred to, at a total cost of 80*l.* The annual charge will thus be raised on the average of thirty years to 5*l.* 13*s.*

It remains for us to put a value on such an engine when thirty years old, and practically such valuations are of rare occurrence. If we estimate that an outlay of 40*l.* will again be required for a general repair, and put a value of 50*l.* on the engine as it stands, we arrive at the total sum of 90*l.*, or less than half price for an engine nearly as good as new. We have known a fifty-horse-power condensing engine working at fifty years old, and said to be "as good as new."

Interest and Depreciation.

We must now attempt to arrive at a specific charge for the depreciation of a portable engine, however open to correction, wherewith to debit the account for threshing.

As to the value of a portable engine ten years old and out of repair any one who has had such a one to sell must have found it a most unmarketable article. Let us suppose it to be worth 40*l.* The original cost of an eight-horse-power engine having been 230*l.*, the depreciation of capital so invested (reckoned at 5 per cent.) is 26*l.* 13*s.* per annum; namely, 2*l.* per annum, the interest of the 40*l.* which the engine will be worth at the end of the period, and 24*l.* 13*s.*, the value of an annuity (calculated at 5 per cent.) which could be bought for ten years for the 190*l.*, the sum supposed to be sunk.*

But besides these charges there are certain other contingent expenses to be taken into account, such as buildings and shafts, straps and covers, which we shall include in the account of the Threshing Machines.

An eight-horse portable engine requires a house 12 feet wide by 20 feet long by 10 feet high up to the plate; the roof should be of galvanized iron; total cost, including large folding-doors, eaves' trough, paving, and tank, 30*l.*, which at 7½ per cent. per annum comes to 2*l.* 5*s.*

The building for a fixed engine should be of a somewhat more substantial character, costing about 40*l.*, and to this we add the cost of building the chimney-shaft (40 to 45 feet high, and made *square* for the sake of economy), setting the boiler, foundation for engine, &c., bringing the total cost to 120*l.* This estimate applies to the Eastern Counties; in the North it would be lower, and in the South rather greater. The rent for this building at 7½ per cent would be 9*l.*

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* In this calculation both interest and depreciation are included.—P. H. F.

Table showing the probable Cost of Repairs and Depreciation for portable Steam-Engines.

Horse-power.	Price.	Supposed Value in 10 Years.	Amount of Depreciation and Interest per Annum for 10 Years.	Amount of Repairs per Annum for 10 Years.
	£.	£.	£. s. £. s. £. s.	£. s.
4	165	30	17 10 + 1 10 = 19 0	10 0
5	180	30	19 9 + 1 10 = 20 19	10 0
6	200	35	21 8 + 1 15 = 23 3	11 0
7	215	40	22 12 + 2 0 = 24 12	11 0
8	230	40	24 13 + 2 0 = 26 13	11 10
10	290	50	31 2 + 2 10 = 33 13	13 10

Charge for Engine-Shed, 2*l.* 5*s.*

Cost of Repairs and Depreciation for fixed Horizontal Engines.

Horse-power.	Price.	Supposed Value in 30 Years.	Amount of Depreciation and Interest per Annum for 30 Years.	Amount of Repairs per Annum for 30 Years.
	£.	£.	£. s. £. s. £. s.	£. s.
4	120	30	5 16 + 1 10 = 7 6	4 10
6	160	35	8 2 + 1 15 = 9 17	5 0
8	200	50	9 14 + 2 10 = 12 4	5 13
10	240	60	11 16 + 3 0 = 14 16	5 13
12	280	70	13 12 + 3 10 = 17 2	6 0

Rent of Buildings, 9*l.*

Repairs and Depreciation of Portable Threshing Machines.

Mr. Willsher's eight-horse-power finishing machine, bought in 1856, has cost:—

			£. s. d.
1856.			
October.	Straps and thongs		0 8 6
1857.			
Nov. 27th.	New brasses	£0 13 6	
December.	Straps	0 6 10	
			1 0 4
1858.			
November.	Machine overhauled, new brasses, and straps ..		2 15 9
1859.			
August.	Machine overhauled, nearly all new brasses, new straps, and repairs		6 18
1860.			
April.	Straps and brasses	3 1 0	
Midsummer.	Thorough repair, new beaters, new concave, new shaker and spindle-screen, spindle, brasses, &c., straps, and painting	31 10 0	
			34 11 0
	9*l.* 2*s.* 9*d.* a-year for five years.		£45 13 7

His seven-horse single-blast machine has cost:—

	£.	s.	d.
1854. Straps, &c.	0	12	9
1855. Brasses and straps, repairs	4	3	0
1856. Shaker-brackets, straps, brasses, &c.	4	11	0
1857. Machines overhauled and general repairs, renewal of brasses, &c.	10	11	0
1858. New drum and concave, general repairs, painting, and wearing parts renewed	27	5	0
1859. Straps, &c.	1	2	6
1860. New brasses and straps, repairs by carpenter, &c.	6	17	0
1861. Machine overhauled, new wearing parts, &c.	9	18	6
8*l*. 2*s*. 7*d*. per annum for eight years.	£65	0	9

The average of our returns is from 8*l*. to 13*l*. a year for an eight-horse-power single-blast machine working two days a week.

Besides the items given there is the cost of driving-straps and of waterproof covers for both engine and machine. The cost of all these depends entirely on the care taken and on the amount of exposure to wet. Either a cloth or a strap doubled up wet will soon be spoiled. We have known a good strap, costing 5*l*., last three years with pretty constant work, but a neighbouring letter-out of machines estimates his expenses in driving-straps for one machine at 4*l*. a year, and in waterproof covers at 2*l*.

Finishing machines, constructed with a double, or often a treble blast, have such numerous bearings and driving-straps, and are so complicated, that the cost of their repairs has been in some cases enormous. Considering the extra power, or the slower feeding, which they require, and that corn can be finished by hand for 1*d*. per quarter, we doubt whether their employment is generally economical.

At all events they require to be simplified, and improvements such as those of Messrs. Garrett and Son, who obtain a blast of air by a fan fixed to the drum spindle, deserve notice and encouragement. Mr. J. C. Willsher has also, with the same object, lately patented an arrangement for driving the shakers and cavings-screen, either with or without a riddle-box and corn-screen, from one crank spindle and with one strap. Messrs. Clayton and Shuttleworth have also introduced a new elevator, consisting of spades or scoops fixed on the same spindle as the blower, which by revolving rapidly throws the corn up into the second dresser and awns the barley, or chobs the wheat, so as to dispense with the straps of the former elevator and barley-awner. Messrs. Ransome's adjustable rotary screen, though ingenious, can hardly be classed among those novelties which tend to simplify the machine.

A survey of the vast amount of ingenuity which has been directed by different makers to the working parts of the machine

—the drum, beaters, shakers, riddles, and more recently to the elevators—creates the impression that no one maker can claim unrivalled superiority over the rest in every respect, but rather that a much better machine would result if the *good points* in each pattern could be combined together.

None but machines by the best makers should ever be selected, however tempting a bait may be held out in other quarters by a lower price. Competition has lowered the prices to a level which will not admit of further reduction without the substitution of inferior workmanship; and this, whether a steam-engine or so simple a machine as a turnip-cutter be in question. Inferior workmanship will always prove the dearest in the end. Among other reasons for buying first-class machinery may be mentioned the importance of having the wearing parts properly numbered, so that they can be fixed by a common smith. The best makers take care to provide these for their customers; others may expose you to disappointment and expense for want of this provision.

Depreciation of Threshing-Machines.

We have seen the *portable single-blast machines* working well at eight or ten years old: to be sure some of them had been nearly re-constructed and paid for twice over in adopting the various improvements introduced since they were first built in the early days of portable threshing-machines. Considering that all these improvements have brought them much nearer perfection, we may safely allot to the single-blast machines a duration of ten years, and to the double-blast that of eight years. We shall suppose them to be worth 10*l.* to 20*l.*, according to size and first cost, at the end of the time. We refer to such machines as are used two days a week, and at the same time well managed. With less work they would of course last longer. It would be a very large farm to find work for a machine even once a week; but in common practice, when not fully employed at home, they are sent out to earn some part of the purchase money; and this is obviously good policy in the case of a machine liable to be superseded before it is worn out.

Fixed barn-works are used far less often, since it is likely that not more than 2000 quarters of corn will be brought to the same spot in one year, and generally much less; yet even this quantity would only employ the machine once a week: the *repairs* will therefore be far less considerable. The wear and tear of a machine firmly fixed and quite level are comparatively small; since it is always in the dry, the charge for the waterproof cloth may be omitted, and that for the driving-strap reduced to 15*s.* Any heavy

expense in repairs or renewal of the parts, such as the drum or concave, ought not to occur for many years after erection; and the usual wearing of brasses, and straps, and other small items of expense, ought not to exceed 3*l.* a year for a term of 14 years.

We make the following extract from a letter of Mr. John Sowerby, jun., of Beelsbey, who has two barn-works—erected in January, 1856, and November, 1857—which thresh the growth of 400 acres of corn a-year:—"The barn-works have cost for repairs, about 3*l.* 9*s.* 6*d.* for one of them until July, 1857, and for both barn-works from that time until December 31, 1861, about 9*l.* 6*s.* 5*d.*, besides 14*s.* 6*d.* for a set of knives for the barley-awner. They were not looked over last summer, but are in good working order." This is only 1*l.* 3*s.* 9*d.* per annum for *each*, for four years.

There is, however, a liability in this, as in the portable machine, to outlay in introducing modern improvements into the working parts; with this in view the machine should be made as simple as possible, and the dressing apparatus should be separate.

As a basis for calculations in our attempt to estimate the exact amount of depreciation, we will suppose the fixed machine to be worth 10*l.* to 30*l.* at fourteen years old; it will probably be worth more, but the valuation ought, on principle, to be low, for it will be remembered that our charge of 3*l.* a year for repairs has not provided for effecting any heavy item of renewal or improvement.

Table showing amount of Repairs and Depreciation for Portable Threshing-Machines—Single-Blast.

Horse-power.	Price.	Supposed Value in 10 Years.	Amount of Depreciation and Interest per Annum for 10 Years.	Amount of Repairs per Annum for 10 Years.
	£.	£.	£. s. £. s. £. s.	£. s.
4	85	10	9 14 + 0 10 = 10 4	8 0
7	100	10	11 12 + 0 10 = 12 2	9 0
Repairs, &c., for Portable Threshing-Machines—Double and Treble Blast.				
5	95	10	13 0 + 0 10 = 13 10	10 0
7	110	15	14 12 + 0 15 = 15 7	12 0
8	120	20	15 4 + 1 0 = 16 4	14 0

For fixed Threshing-Machine to finish the Grain for Market.

Horse-power.	Price.	Supposed Value in 14 Years.	Amount of Depreciation and Interest per Annum for 14 Years.	Amount of Repairs per Annum for 10 Years.
	£.	£.	£. *s.* £. *s.* £. *s.*	£. *s.*
7	120	20	10 2 + 1 0 = 11 2	3 0
Repairs, &c., of fixed Threshing-Machine with separate Dressing Apparatus and Elevators.				
8	140	30	11 2 + 1 10 = 12 12	4 0
For fixed Threshing-Machine—Single-Blast.				
5	80	10	7 0 + 0 10 = 7 10	2 10

*Cost of Threshing.**

Since the cost of maintaining a 7-horse-power portable engine amounts to 35*l.* 12*s.*, and of a 7-horse-power single-blast machine —including 3*l.* a year for driving-strap and waterproof cover— to 24*l.* 2*s.*, the number of days each is used in a year must be ascertained, in order that the proper proportion may be charged to each day's work. Our calculations have been made on the supposition that the threshing is confined to the work of one large farm; if the engine is let out, a different estimate must be made.

The following are the average quantities of corn threshed in a day of 10 hours by a 7-horse-power portable engine and single-blast machine, in use 3 days a week on an average, in a good district in Essex.

The owner of this machine found that an 8-horse-power engine and finishing machine averaged about the same amount of work as a 7-horse-power single-blast machine, for the years 1860 and

* It may be interesting to note the latest prices for threshing by flail, on a large farm in Surrey :—

	Prices for 1860.		*Prices for* 1861.	
	s. *d.*		*s.* *d.*	
Wheat	4 0	per quarter.	4 0	per quarter.
Barley	3 0	,, ...	2 9	,,
Oats	1 10	,, ...	1 8	,,
Peas	2 3	,, ...	2 3	,,

My informant states "the price for labour has risen considerably in this neighbourhood during the last few years. The price for wheat threshed would, a few years since, have been 6*d.* or 8*d.* per quarter less than in the last two years. The present labourers want to work less and to earn more than those of the last generation."

This sounds like the knell of one of the departing customs of our fathers.

1861; the average quantity of coal, costing 18*s.* per ton, used for the former was $8\frac{3}{4}$ cwt., and for the latter $7\frac{1}{2}$ cwt.

Expense of a Day's Threshing by Single-Blast Machine, estimating the Engine to be used on the farm once a-week, and the Machine thirty days a-year.

Crop of 1860 (a wet harvest):—

Reaped wheat,	46	quarters,	at 1*s.* 9*d.*	per quarter.
Mown ditto	38	„	2*s.* $1\frac{1}{2}$*d.*	„
Barley	33	„	2*s.* $5\frac{1}{4}$*d.*	„
Oats	50	„	1*s.* 7*d.*	„

Crop of 1861 (a fine harvest and average crop):—

Reaped wheat,	52	quarters,	at 1*s.* $6\frac{1}{2}$*d.*	per quarter.
Mown ditto	46	„	1*s.* 9*d.*	„
Barley	40	„	2*s.*	„
Oats	55	„	1*s.* $5\frac{1}{2}$*d.*	„

Details of Cost by Single-Blast Machine when worked in the Field, and Straw left stacked on the spot.

	s.	*d.*	£	*s.*	*d.*
1 engineer	3	6			
1 feeder	3	6			
2 to supply, &c.	3	0			
3 on stack	6	0			
1 to shake straw	2	0			
1 to pitch ditto	2	0			
3 to stack ditto	6	0			
1 carting water and coal	1	4			
1 horse ditto	2	6			
2 men to load and carry corn	4	0			
1 to drive	0	9			
1 horse	2	6			
3 to move and carry chaff and cavings to barn	2	6			
1 horse ditto	2	6			
			2	2	1
Depreciation and repairs of engine, supposing it to be used on the farm once a week			0	14	2
Depreciation and repairs of machine, 30 days a-year—with say 3*l.* a-year for driving-strap and waterproof covers			0	16	1
Oil and $7\frac{1}{2}$ cwt. of coal			0	8	6
			£4	0	10

Cost of Threshing with Double-blast Machine.

	£	*s.*	*d.*
Labour as in the case of the 7-horse power single-blast machine	2	2	1
Depreciation, &c., of an 8-horse power engine	0	15	3
Depreciation of machine	1	2	1
Oil, and $8\frac{3}{4}$ cwts. of coal	0	10	0
	£4	9	5

Expenses of a day's work of a 4-horse-power machine estimated as before.

Crop of 1860:—

Reaped wheat,	30 quarters,	at 1s. 11*d*.	per quarter.
Mown ditto	20 „	2s. 10½*d*.	„
Barley	23 „	2s. 6*d*.	„
Oats	30 „	1s. 11*d*.	„

Crop of 1861:—

Reaped wheat,	36 quarters,*	at 1s. 7*d*.	per quarter.
Mown ditto	30 „	1s. 11*d*.	„
Barley	28 „	2s. 0½*d*.	„
Oats	35 „	1s. 7½*d*.	„

Coal used, 5 cwt. a-day.

Details of 4-Horse Power Machinery, as in the former case.

	s.	d.	£	s.	d.
1 driver	3	6			
1 feeder	3	6			
1 to supply ditto	2	0			
2 on stack	4	0			
1 on straw-stack	2	0			
1 to pitch ditto	2	0			
1 to move corn and load it	2	0			
1 horse ditto	2	6			
1 to drive	0	8			
1 to rake chaff and cavings, and help load	1	0			
1 to drive ditto to barn and fetch coal and water	1	4			
1 horse for ditto	2	6			
			1	7	0
Depreciation of engine			0	11	7
„ machine			0	13	5
Oil and coal, 5 cwt.			0	5	6
			£2	17	6

To these average results it may be interesting to add the particulars of two trials made by the writer on January 21 and 22, 1862, with a single-blast machine, made in 1854, driven by an 8-horse-power engine, made in 1856, by Messrs. Clayton and Shuttleworth. On the second day we threshed of mown wheat 10 qrs.; of straw, 61 cwt.; of cavings, 4¾ cwt.; of chaff, 7 cwt. per hour. The crop was not heavy, only about 4 qrs. per acre. This gives 25 acres threshed in 10 hours, yielding 100 qrs. of wheat, 30½ tons of straw, 5 tons 7 cwt. cavings and chaff. This was a larger proportion of cavings and chaff than that obtained at other trials.

* Forty-four quarters was the maximum in one day. To each of these estimates we must add 4½*d*. per quarter for incidental expenses (see p. 336), and in the case of single-blast machines 2½*d*. per quarter for dressing twice and measuring. In practice it is usual to dress once and re-measure, even after the so-called finishing-machine, partly to get a uniform sample, and partly to improve the dressing and obtain accurate measure.

The number of men and lads employed was 19; they had a short distance to carry the straw: 12 cwt. of steam-coal were used.

On the first day we threshed 8 qrs. of barley an hour, having five men on the stack and two on the stage to supply the feeder, and the machine could certainly have borne faster feeding if the men on the stack could have delivered the straw faster. The corn, in a day of ten hours, would have amounted to 80 qrs., the straw and cavings to 23½ tons, and the chaff to 1 ton 1 cwt. The crop was only 5 qrs. per acre, and the straw long and coarse.

The number of hands employed, including two lads, was twenty-one. The costs, with these maximum results, adopting our former calculation, would be 1*s.* per qr. for the barley and 9½*d.* per qr. for the wheat.

But we have not yet stated the whole of the expenses of threshing in the field, which include the cost of removal, of clearing up, and of thatching the stack; and for purposes of comparison with threshing by flail we ought also to bring the straw to the barn or yard. Removals may probably take five horses and one man a quarter of a day on the average every time the machine is used, and cost say 3*s.* 4*d.*; clearing up, one horse and a boy, 3*s.* 4*d.*; thatching, at 6*d.* per square, 4*s.*; for 15 tons of straw, a fair day's threshing, carting home the same quantity of straw, 7*s.* 6*d.* These expenses of course vary with the site of the stack, the convenience or otherwise of storing, and the care taken of the straw, and the attention or neglect of neatness in the stack-yard; on the whole we believe them to be no more than the average. It will be seen that they add 18*s.* 2*d.* to the expenses of a day's threshing, or 4½ per qr. at 48 qrs. per day, to the cost of separating the grain from the straw and chaff and of carrying each to the barn.

Portable straw elevators may be referred to as a means of assistance in certain cases, though their price and cost of removal precludes their being used with economy where labourers can be obtained at 2*s.* per day. The cost of one to deliver straight is about 50*l.*, or to deliver at any angle, about 60*l.*, varying according to length. Their sale has been almost entirely confined to districts where labourers are scarce.*

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* I do not concur in these remarks. I first bought one straw-elevator to accompany one of my machines, and found it so useful and so much approved, that I have since purchased another; but the price charged seems to me too high for so simple a machine. Messrs. Ransome's new iron elevator, which packs into the threshing-machine, will probably act very well in careful hands, but hirers are too often hasty and unskilful.—P. H. F.

Threshing by Fixed Machine, Eight-Horse-Power.

	£.	s.	d.
Depreciation and repair of engine supposing it to be used once a week	0	7	1
Do. Do. Machine, 30 days a year ..	0	9	4
Oil and 8 cwt. of coal	0	9	0
Interest on building (proportion of £9) ..	0	3	7
Do. on elevation and shafting, £50	0	3	0
Labour (as previously detailed)	1	9	6
	£3	1	6

The last item includes eight horses to cart the crop from the stack, and eleven men and boys. The straw is carried into the straw-rick by elevators consisting of an endless web, which may be put up at the expense of from 10*l.* to 20*l.*, according to length.

On farms where much straw is used for feeding, the expensive process of cutting it into chaff may with very great economy be carried on at the time of threshing. Ten tons of chaff may be cut in a day, and supposing from 12 to 15 tons of straw to be threshed, the remainder is stored elsewhere. The cost of chaff-cutting by steam power has been recently estimated in the Journal at 6*s.* per ton, which we consider a fair average price; but in this case it is cut at only the cost of the extra coal, and of the two men to "yelm" the straw and feed the machine, the straw being brought to it by the web, and the chaff either falling into the store-room or being taken there by the exhaust tube. To enable a smaller engine to do this double work the threshing-machine may be fed slower than usual with economy. It takes four or five horse-power to work the chaff-machine, but the so-called eight or ten horse-power engines give at least half as much power again as their name implies.

Mr. Jonas's practice, when both cutting chaff and threshing, is to apply the power to a strong extra shaft fitted to the front of the threshing-machine; from two pulleys affixed to this shaft both the drum and the chaff-machine are driven; in this manner no extra strain is put upon the drum-shaft. By these means the whole of the cost of stacking, and afterwards bringing the straw to the chaff-engine, is saved. It is thus cut and stored at very little more expense than the cost of a few extra cwts. of coal for the engine. The credit of these really practical and economical arrangements is due to Mr. Maynard of Whittlesford. Mr. Jonas showed us a barn in which he was in the habit of storing the produce of nearly 100 acres of straw cut into chaff, and well trodden; and since the chaff, when well salted and trodden in a dry place, heats slightly and improves with keeping, this method of storing may be recommended as a means of getting rid of the

accumulation of the straw about the premises at certain seasons of the year.

It may be useful to know how much chaff, well trodden in, will go into a certain space: one of our own chaff-houses, in which we have tried the experiment, is 35 feet long, $15\frac{1}{2}$ feet wide, and 11 feet high. Its content is therefore 5967 cubic feet, and it holds $19\frac{1}{2}$ tons of wheat-straw chaff, = 306 cubic feet per ton. Eight acres of mown wheat-straw, of last harvest, rather a heavy crop, weighed exactly 12 tons, and occupied a space, when trussed and stored in the straw-rick, of rather more than 12,000 cubic feet. In round numbers, trussed wheat-straw occupies a space of 1000 cubic feet per ton:—more, if stored loose and untrodden; less, if well trodden with horses: cut into short chaff and well trodden, it takes less than one-third of that space.

The combined arrangements for threshing and cutting chaff at the same time, are becoming all the more practicable from the increased power of the engines in common use. In 1851 the average of the portable engines made by Messrs. Clayton and Shuttleworth was five-horse-power, and in 1855 nearly seven-horse-power. And as the question of steam-ploughing becomes more and more one of practical utility and economy, there is no doubt that the larger engines will be the most desirable upon farms.

Gosfield, Halsted.

XX.—*The Present State of the Sewers and Water Supply of Paris.* By P. H. Frere.

England may well look with interest to the changes made or contemplated in France for the disposal of that town-refuse which is a possible source of wealth, but, if ill dealt with, a certain cause of annoyance; and indirectly its Agriculture is concerned in the result. With us, to a certain extent, the die is cast; the contents of the closet have penetrated, with the kitchen refuse, &c., into the common sewer, into which they are washed by an unrestricted supply of water. To set up a wall of separation—to limit the amount of dilution—would in themselves be steps of extreme difficulty, because in one sense retrograde. Paris, on the other hand, is still, in the main, uncompromised. That city is in a state of transition; generally the old-fashioned pit still exists, for the most part unsupplied with water; but a large water-supply has been procured for houses of the better sort. But even then the soil-pit still remains wholly or partially separated from the common sewer, and the question still is to be decided whether

this separation, whole or partial, shall be maintained; and consequently whether the night-soil of Paris shall retain, as heretofore, all its solid and liquid constituents, or only the former; and again, to what extent these fertilisers shall henceforth be diluted.

After the great works undertaken to procure a water-supply from the Seine, from the Canal de l'Ourcq, and from the great Artesian well, every householder who is willing to pay the rate can have a supply of water for water-closets as well as other uses. The water company, however, endeavours to regulate and limit the supply contracted for, by making only such an aperture as will allow the amount paid for to pass in a continuous stream into an inner cistern in twenty-four hours. The following is the estimated rate of consumption:—

	Litres.	Gallons.
For a man	30	$6\frac{1}{10}$
„ carriage	75	$16\frac{1}{2}$
„ horse or cow, &c.	100	22
„ water-closet	75	$16\frac{1}{2}$
„ garden or court, per square mètre ($10\frac{1}{2}$ feet)	5	$1\frac{1}{10}$

A contract may be entered into for 500, 1000, 1500, &c., litres per day, for an annual payment of 60 fr. for Seine water, or 50 fr. for Ourcq water, per 500 litres (110 gallons). The use of the water-closet is then inaugurated; how is it henceforth to be regulated?

The builder who contemplates making a house must communicate to the Board his plan of operation; the choice open to him will depend on the locality. The new Boulevard de Sebastopol, with its costly and magnificent system of sewers, is the type of the new regulations. If the house be in that quarter, a separate pit must be provided for the soil; but it will be so connected with the main sewer that the nightman will have access to it therefrom, and without entering or disturbing the dwelling will first deodorise and then let off the fluid into the sewer, and afterwards convey away the solid "soil" through a passage in this new subterranean town to the cart, and to the reservoir. Otherwise, by another plan under consideration, the soil, &c., would drop into a cylindrical cistern, divided vertically by a perforated metal screen or sieve, through which the fluid percolates of itself into the sewer. In either of these cases the fluid elements are lost, and if these contain the higher percentage of nitrogen, the loss may be much more than *pro ratâ.*

It remains to be seen whether, since this magnificent network of drains has been already organised to retain the fluid as well as solid excrement, and other means have been provided for dealing with the soil, it will pay by enlarging the pits, emptying them more often, and restricting the supply of water used in the closet. One important step has been taken towards this end. A tank

fitted to a railway-truck, containing 6 to 10 tons, has been made and exhibited in our International Exhibition, which will be conveyed for 60 miles on the Eastern Railroad at a charge of 2*s.* for 6 tons. The present "night-soil," when delivered in "hungry" champagne, is valued at 8*s.* per ton. If then the "soil" retain anything like its old strength, its value to the farmer will leave a large margin to pay for its transport along the subterranean street to a reservoir at the railway terminus. But if there be a great dilution, and many small sources of supply have to be visited and tapped in succession, the costs of removal will roll up, until this "gold may be bought too dear."

At all events those philanthropists and philosophers who long to see the circle of reproduction completed by the restoration to the field of all the human fæces which contaminate our great cities, must cast a curious and anxious eye to the magnificent new French suburb, where, if anywhere, their views may be economically realised, because a solid foundation has been laid, and there are means and appliances for the distribution, which only wait for one or two connecting links. In other quarters of the town practical improvements have been introduced, by which the carts are filled at night by means of a joint and hose fastened to an opening in the pit, so that it is emptied from the street by suction. The loaded cart then proceeds to the *dépotoir*, or sink, from which the deposits are propelled by a steam-pump through a tunnel 7 miles long, to an opening cut in the Forest of Bondy. Here they are either desiccated and made into *poudrette*, or shipped by barge-loads along the Canal de l'Ourcq to Vaujours and elsewhere.

The Water Supply of Paris.

For centuries the supply of water for Paris has occupied the attention of the French Government. Philip Augustus erected the first fountains; his successors and the municipality organised in the squares and open spaces supplies of water drawn from the northern springs. Marie de Medicis, restoring a Roman aqueduct, led in the waters of Arcueil. In the reign of Louis XIV., pumps were placed by the bridges of Notre Dame and the Pont Neuf, to raise the water of the Seine. A century later similar works were set up at Chaillot. But they all turned their backs on drains, and sewers and their contents, leaving the sun, the rain, and the river to settle those matters.

Water which had served domestic purposes ran in streams down the streets in mid-channel, and either joined the Seine on the south, or on the north the ditch of Ménilmontant. This ditch, when its exhalations began to threaten the health of the neighbourhood, was paved and vaulted, and converted into the main

sewer which encircled the town. The outscourings were allowed to run into pits in the open fields; and the night-soil collected in the pits underneath the houses was taken away by night, to be thrown first into the charnel-house of Montfaucon pell-mell with the bones of criminals, and afterwards into the empty plaster-pits of Buttes Chaumont. Such was the system which survived to our own times. We may add, that from the sixteenth century the gardeners who cultivated the marshes of the Temple, applied to their land the sweepings and straw-manure of the town; and when Paris, spreading daily, ejected them from within its bounds, by means of this same manure they converted the plain of Vertus into a garden of inexhaustible fertility. Bridel, too, about 1780, formed the idea of solidifying, by drying, the thick liquid in the basins of Montfaucon, and manufacturing *poudrette*, by which the first company of adventurers was enabled to pay a rent of 22,000*l.* and reap a handsome profit.

The sanitary reform of Paris dates from 1830. The completion of the Canal de l'Ourcq, which delivers 100,000 tons of water, at a level of 27 yards above the Seine, altered the whole state of the town. The principle was adopted that a group of houses constituted a block (*îlot*), to be scoured by a stream of running water, and provided with a water-post (*borne fontaine*) on a high level, and a sewer's mouth below. An end was thus put to the torrents of filth which had hitherto deluged the streets. These were relaid in a convex form, skirted by foot pavements; and under all the main thoroughfares waterpipes and drains were laid. The management of the night-soil underwent a like change. M. Mary was so adventurous as to propose to construct a syphon $7\frac{1}{2}$ miles in length, terminating in the reservoir of Bondy, for the purpose of emptying the pestilential pools of Montfaucon. This scheme was unprecedented, and apprehensions were entertained that the pipes would become choked by the pasty matter. After five years' opposition he gained his point, and the construction of the "dépotoir" was the result. This work consists of an assemblage of cisterns, into which the produce of each night's carting is emptied. The contents are then forced by a steam-pump through an iron pipe to a clearing of 75 acres made in the middle of the Forest of Bondy, well out of reach of Paris and its atmosphere. M. Mary calculated that this pipe, which traversed the market-gardens of Noisy, might furnish liquid manure, to be sold at a cheap rate at convenient stations. But the practice of buying town-sweepings and stable-manure was so established that, until 1850, night-soil was overlooked; nor was any attempt made to introduce its use in the environs, prior to the experiments which led to the establishment of the farm of Vaujours.

About 1850, the introduction of railroads gave a new impulse

to the improvements of Paris. Traffic of all sorts was increased tenfold, and, as a consequence, streets required to be widened, and the whole town, as it were, re-organised. Then it was that Government came forward and sketched the plan, which is realised in the magnificent city such as it now stands.

Two great lines intersect one another at right angles, so as to form a cross—an idea of the time of Philip Augustus: the one, the Rue de Rivoli, runs parallel to the river; the other, the Boulevard de Sebastopol, comes sloping down from the hills on the north, and again rises to the south. On the latter line sanitary arrangements have been comprehensively planned and carried out. We find a complete subterranean town, provided with vaulted thoroughfares 35 yards wide, macadamised or paved, which contain sewers showing a section (*profil*) of 3, 4, or 6 yards, with polished sides and serviceable foot-pavements, in which, through an inner channel, the stream of sewage-water flows, fed at the corner of each street by lesser sewers, themselves drawing their supplies from the drains which abut on every house. This is such a scheme as the English *Board of Health* suggested, but with this difference, that instead of a system of small pipes, provision is here made on a large scale for all the requirements of town life, including water and gas. Besides the rain-water and that which has been used for domestic purposes, the drainings from the closets run down these channels, the solid portion of the deposit being retained in the pits by the filter. There is no connection with the outer world: the system is self-contained; water and gravitation are the sole agents employed.

The drains connected with the private houses are oval sewers, 4 feet 2 inches by 7 feet 6 inches, in which the workman passes easily to and fro with his barrow. The main drains, constructed under the great lines of traffic parallel with the river, are circular tunnels of 10 feet in diameter, containing a railway with a 3 feet 11 inch gauge, and a channel for the waters between the lines of rail. Lastly, the main sewer, which forms a chord to the windings of the Seine, between the Pont de la Concorde and the Pont d'Asnières, is an elliptic tunnel, having a horizontal diameter of 20 feet, in which is contained a canal 11 feet 8 inches wide, traversed by a barge, with a footpath on either side 3 feet wide. All these works are executed in cement, so that the smooth and polished walls and their softened outlines reflect the light, transmit sound, and give free passage to the waters, which leave no taint behind. From the dwellings they received grease, the refuse from the kitchen, and the household water (*eaux menagères*), as well as the disinfected liquids drawn from the pits of the closets. The paved streets transmitted their mud, and

the macadamised boulevards their scrapings. Markets, slaughter-houses, barracks, paid their tribute of manure—vegetable refuse, blood, urine, or undiluted night-soil. This confused mass, mixed with water, issued from the sewer's mouth at Asnières, in a thick and dark stream, flowing at the rate of 1 ton per second.

To provide against the accumulation of a great mass of filth near the sewer's mouth, the following ingenious device was adopted :—

The centre of the main drain is occupied by a canal $2\frac{1}{2}$ miles long, having a fall of 1 in 2000. On this canal a barge is employed, from the fore part of which is suspended a metal floodgate (*vanne*), which fits exactly to the sides of the tunnel up to a certain water-level, and lowered by leverage to within a few inches of the bottom. By these means the stream is headed up behind the floodgate, which as soon as there is a head of two feet of water forces out through the small aperture left below a perfect torrent of refuse, sand, and even stones, which are mashed and rolled together, and thrust onwards in a long drift 100 yards in advance.

As the barge itself is propelled slowly forwards by the stream which it holds in check, the torrent keeps advancing, and the outscourings never find a resting-place till at the end of ten days the mouth of the sewer is reached. The boat then performs its backward journey by the aid of floodgates lowered from the roof. These, acting like locks on a canal, raise the water to an artificial level for a distance of 11,000 yards at a time, by which means the barge is gradually floated back.

The lighting and signals had still to be provided for. At first small lamps, such as are fixed to railway trains were tried, but their light was found to be too dazzling to those in front, whilst it left those in the rear in deep shade. A common oil-lamp in a glass globe, distributing its light equally around to a distance of ten yards, was ultimately preferred. Red, blue, and green railway-lanterns answer perfectly for signals.

Thus far provision had been made for cleansing the town, but at the cost of the Seine, where a pestilential delta would be formed at the sewer's mouth. The great point was to extract all solid matter from the stream without interrupting its flow ; this alone would lodge and accumulate ; this would interfere with working pumps for irrigation ; liquids would float away with the stream, and would undergo slow combustion when in contact with the air, and vanish.

The various solid bodies contained in the stream, though blended together by the flood, would not really mix or amal-

gamate. Their specific gravity would determine their position; the grease would float, the sand sink rapidly, straw and organic matter would be found in various degrees of suspension. They must all be disposed of.

The grease is, in great measure, collected as a scum behind the barge, where it is skimmed off and employed in making black soap.

The first attempts at "straining" the stream were unsuccessful. The straw manure required a special device.

A simple bar became blocked with a tangled mass of straw and dung. A barrier of plate-iron pierced with holes, made to fit the aperture exactly, and therefore 8 ft. 8 in. wide, which was fixed in a sloping direction, hardly arrested any of the floating substances. The openings were bunged up, and the straw, &c., glided up the inclined plane and topped the fall.

The last device was to make a wooden grating with bars placed lengthways, $\frac{3}{4}$ inch wide and $\frac{3}{4}$ inch apart, inclined in the direction of the stream's flow. The length of the incline was 26 feet, which gave a slope of 1 in 5. The workmen, armed with rakes, who combed and scraped the gratings, collected as much as five or six tons of rubbish per day.

Whilst the work was still experimental the sewer supplied in four months 500 tons, which was not only so much infectious matter got rid of, but manure placed at the service of agriculture.

The nursery gardens of the Bois de Boulogne were not slow in adopting its use, and found its action very rapid—as the gardeners say, if you expose it for twenty-four hours to the air it takes fire: with alternate layers of clay or marl it forms an excellent dressing.

To return to our subject,—the collecting the sand which moves along the bottom of the sewer was a very simple matter: only make a barrier, and a bank will soon be formed against it, which the steam-drag, such as is worked in the Seine, will readily remove. Even these sands may be serviceable to agriculture: they are fine, and blackened with organic matter like peat, and may therefore prove a useful dressing to chalk and clay lands.

Accumulations of gas remained to be dealt with. Where there is sewage-water, it is always accompanied by a discharge of carbonated hydrogen gas, which rises to the surface in numerous little bubbles. As the sewer has been so planned as to have a fall of about 13 inches where it joins the Seine, the water, when broken in the fall, parts with a portion of the gas contained in it. To take advantage of this, a cowl has been built over the cas-

cade, which is surmounted by a fire of glowing coke; the blue flame of the carbonated hydrogen is easily recognised at the top of the vent, where it mounts and undergoes combustion, instead of bubbling up in the fleeting current.

To sum up these details; the foul stream which enters the sewer of Asnières to be turned into the Seine at the lowest possible point, first encounters the barge with its moveable flood-gate. Finding no escape but by the aperture near the bottom, it is converted into a scouring torrent, which whirls along all the deposits for a distance of 2½ miles. A sort of floating island of scum is formed round the boat, from which the grease is collected for industrial purposes. At the mouth of the Seine the stream next encounters a long grating, suspended in mid-channel but disconnected with the bottom that the sand may pass freely. There it parts with all its floating substances, such as straw, vegetables, or wood, which form a bed (*paillasse*) on the inclined plane, from whence they are removed by drag-rakes.

Still farther on, a bar is so placed as to form a fall of 13 inches: the sand is thus arrested, and the bank which it forms is continuously removed by the scoops of the steam-drag. The hood, with its fire of coke, placed over the fall, attracts and consumes the noxious gases.

The solid and gaseous bodies being thus disposed of, nothing remains but the fluid, which contains matter in chemical solution, and this may properly be turned into the Seine, because its purification will soon be accomplished by slow combustion under the influence of the atmosphere; the dark stain caused by its admixture will soon be obliterated, and before reaching Passy the river will have regained all its purity.

These statements have been chiefly derived from two Reports by M. Mille, published in the Appendix to the 'Annales de Vaujours.' For further explanations I am much indebted to the excellent models of sewers exhibited, among many others, in the French Department of the International Exhibition, as well as to the courtesy and patience with which the gentlemen in charge of these models have answered my inquiries.

When examining these models, I at the same time saw with interest the pipes manufactured by M. Hermann et Compagnie, contractors for the Paris waterworks. These pipes are perfectly smooth within and without, and uniform from one end to another, without any kind of projection. When a joint is to be formed, a band of indiarubber is slipped over the ends of two pipes placed in juxtaposition. Over this band two iron rings, slightly conical in form, lying ready to hand on either pipe, are driven home till they almost meet. By this simple but effectual kind of joint, the

use of solder and of skilled labour is dispensed with, the readjustment of one or two lengths much facilitated, whilst it is found in practice that for any given bore, required for any purpose, one-fifth less iron may be employed than has been usual. The pipes of all sizes now laid down for the Paris Waterworks are thus united.

XXI.—*On Poisonous Cheese.* By Dr. Augustus Voelcker.

About two years ago, one of my assistants, soon after having partaken of some cheese, was attacked with violent vomiting and purging. Several other persons who had eaten of the same cheese were similarly affected. On inquiry, the grocer by whom the cheese was sold stated that, in all probability, the dairymaid had used a little too much vitriol in making this cheese. I was not aware till then that anything so injurious as vitriol was ever thus used; but the readiness with which this supposition was expressed shows that at least in some quarters this injurious substance is openly put into cheese for some purpose or other.

The chemical examination of the poisonous cheese showed the presence of white vitriol, or sulphate of zinc,—a compound highly injurious to health. On further inquiry, I learned that this compound is occasionally used for the purpose of giving fresh cheese the peculiar biting taste of old. Many other samples were subsequently analysed by me; and, although the great majority were perfectly free from any poisonous matter, in one or two I found sulphate of zinc, and in a few others blue vitriol, or sulphate of copper, which, perhaps, is a still more poisonous compound.

It appears that blue vitriol is employed to prevent heaving. A dairy farmer in our neighbourhood informed me that on his farm, in his father's time, it was employed in small quantities for that purpose. On taking possession of the farm, he, knowing blue vitriol to be injurious to health, directly forbade its use, but found it difficult to prevent his dairymaid from abstracting some of the blue vitriol which was used for pickling the seed-wheat. In the opinion of this gentleman, many dairymaids use blue vitriol; and his view is confirmed by others, as well as by the actual detection by me of this poisonous matter in several samples of cheese.

In most cases, no doubt, this is done in ignorance of its deleterious properties; and it is for this reason that I would draw attention to this objectionable practice.

I am told alum is sometimes used for the same purpose, but I

have not myself found it in cheese. Though not absolutely injurious, such a use of alum is quite unnecessary; for the heaving of cheese can be entirely prevented by proper management, and all articles of food should be entirely free from substances which have any medicinal effect.

Quite recently an instance of supposed poisoning by cheese was brought under my notice by Mr. Henry White, of Warrington. In April last, Mr. Roger Bate, cheese-factor, Warrington and Tarporley, brought an action in the Northwick County Court to recover damages sustained by the purchase of a dairy of cheese, a great portion of which was said to be unfit for human food. In the trial the following particulars were stated. In August, 1861, Mr. Bate called at Mr. Buller's farm, Little Badsworth, with a view to purchasing his dairy, and, after inspecting a quantity of cheese and approving of it, he agreed to purchase the whole season's make at the rate of 60*s.* per cwt., of course expecting that all the cheese delivered to him would be a good marketable commodity.

The first lot was delivered in the course of September, and some of it sold to the Warrington workhouse; but the cheese was returned, with an intimation from the governor that it was unfit for food, being found to cause sickness and vomiting to a very violent degree.

Another portion of the same lot was sent to Messrs. Fletcher, of Manchester. After it had remained in their hands a considerable time, they met with a customer in the person of a Mr. Hulton, of Failsworth, who, in a few days returned it, declaring it to be poisonous. Mr. Bate then put three cheeses into the hands of a person named Fay, who was in the habit of attending the St. Helen's market, but complaints were soon made to the public officers of the place that Fay was vending a poisonous article. Another hawker, of the name of Pemberton, also received a cheese, which he brought to Northwick, where several people were taken ill after partaking of the cheese. A number of people were examined, who all bore witness to the poisonous character of the cheese.

Mr. H. White, of Warrington, with his accustomed promptness and zeal for the interests of agriculture, procured from Mr. Bate a piece of cheese that had made eight persons out of nine ill that had partaken of it, and forwarded it direct to me for examination.

In due course I sent the following Report to Mr. White:—

"This cheese presented nothing in appearance which may be regarded as an indication of its spoiled condition or unwholesome quality. The taste, it is true, is sharp, peculiar, and quite

different from the rich and pungent taste of well-ripened old cheese; but it is not sufficiently characteristic of its unquestionably poisonous properties. Having analysed at different times cheese which produced bad effects when taken in any quantity, I cautioned my assistants not to take too much of it, and invited them to taste the cheese sent by Mr. White. Certain chemicals which are sometimes put into cheese can, to a certain extent, be recognised by the peculiar taste which they impart. I tasted it myself, and, although I only took a piece the size of a hazel-nut, I felt its effects four hours after having tasted it. Both my assistants, who had taken not more than at the most a quarter of an ounce each, five hours afterwards were violently attacked with vomiting and pain in the bowels: One of them was ill all night, and scarcely able to follow his usual work next day. Both complained of a peculiarly nasty mercurial taste, which seemed to remain with them for many hours after they were taken ill, and both turned deadly pale five hours after partaking of the cheese. On a former occasion, I found sulphate of zinc or white vitriol in a cheese, which caused sickness; and in another instance I detected in cheese sulphate of copper. My attention, therefore, naturally was directed to search for metallic poisons; but, though carefully operating on large quantities, I failed to detect even traces of zinc, copper, mercury, antimony, arsenic, or any of the metallic poisons which might have possibly imparted injurious properties to the cheese.

Having failed to detect any mineral poison, I next directed my attention to the examination of the organic constituents. The quantitative general analysis gave the following result:—

Water	37·88
Organic constituents	58·04
Mineral constituents	4·08
	100·00
Containing common salt	1·33

The proportion of water in this cheese is rather large, considering that it must have been cut for some time, and have lost water by evaporation. On further examining it, I found it remarkably sour, and had no difficulty in detecting an unusually large quantity of fatty acids, which, if not poisonous themselves, are the vehicle conveying the peculiar organic poison which appears to be generated sometimes in cheese undergoing a peculiar kind of fermentation. Probably the poison generated in this modified decay of cheese is identical with the so-called sausage-poison which is sometimes found in German sausages, especially those made chiefly from coagulated blood. A similar poison appears to be generated sometimes in pickled salmon,

smoked sprats, pork, tainted veal, bacon, and hams. Bacon and hams, when not perfectly cured, and fat meat kept in a damp, badly ventilated cellar, are very apt to become more or less injurious to health; and even butter, after it has turned rancid, and similar organic acids are liberated in it which exist in this cheese in a free state, acts as a poison in most cases. Singularly enough, some people are not affected by these subtle organic poisons. The poison of cheese was known in Germany as long ago as 1820, and probably even earlier; a great deal has been written on the subject, but we are yet as far as ever from knowing the composition of this virulent poison. This, however, we know, that it is developed when the curd of milk is kept too long exposed to the air before it is salted; or kept in damp, badly-ventilated places; or when too much whey is left. In fact, all the circumstances which tend to produce an acid curd, and to generate free fatty acids, are apt to produce this peculiar poison. In old cheese, it is true, we have similar fatty acids, but they are here united with ammonia, and in this combination harmless. What is more strange, poisonous cheese of this character, when kept until it becomes quite decayed, loses its poisonous properties and becomes wholesome.

I am well acquainted practically with the sausage and cheese poison, for in Germany a great many cases of poisoning with cheese have happened, terminating fatally.

It has been noticed that this peculiar organic poison is particularly apt to be generated when curd, before being salted, is left for some time in a heap until it begins to ferment. The cheese made of such curd ripens more readily than when made in the ordinary way; but at a certain stage of its decay it is a poison which acts far more energetically than sulphate of zinc or even sulphate of copper.

It is to be regretted that we have no ready means of detecting this insidious poison. One indication, however, that there is something wrong, is to be found in the strong acid reaction which poisonous cheese always exhibits when tested with litmus paper. A slight acid reaction marks all fresh cheese; but whilst the outside of good old cheese is ammoniacal, I find that the outside of cheese in which this peculiar poison occurs is acid."

Cases of poisoning by cheese in which no mineral poison can be detected occur much more frequently than is generally supposed.

In the same paper in which the Northwick trial is reported, singularly enough, the following paragraph is copied from the 'Globe'—

"*A Family Poisoned through eating Cheese.*—On Saturday morning, informa-

tion was received by one of the Middlesex coroners of the death of a mother and child, from a family of four, who, it is alleged, have died through eating cheese containing some poisonous agent. The information given is that the name of the family is Sutton, of 12, Falconer's Alley, Cow Cross; and that on Thursday last the mother sent for a quarter of a pound of cheese between herself and three children, and shortly after they had partaken of their meal the whole of them were seized with violent vomiting and internal excruciating pain, which continued until they were in a complete state of exhaustion. On the arrival home of the husband, finding his family in such a deplorable condition, he called in medical assistance, when an opinion was given that they were suffering from fever, and an immediate order for their removal to the Fever Hospital in the Liverpool Road was given. Charles Sutton, six years old, died that same night, and the mother on Friday afternoon. The deaths of the two other children were also expected. The medical gentleman at the hospital who had the deceased in charge, is of opinion that the deaths have been occasioned by poison, and refuses certificates. An inquest will therefore be held."

This paragraph, it will be seen, refers to a case of poisoning by cheese in all probability similar to that examined by me.

Royal Agricultural College, Cirencester, July, 1862.

XXII.—*The Cross-breeding of Cattle.*—By J. Coleman.

Having been engaged for some ten years in the breeding of cattle of several descriptions as well as in the purchase of a large number for fattening purposes, I am induced, Mr. Editor, to send you a short paper upon the subject of cross-breeding, in the hope that you may think it worthy a place in the Journal.

My views must be taken for what they are worth, and I cannot venture to hope that old breeders will agree with me on many points: but I trust that these few remarks may be of use to some of those who are starting in life, since my experience has led me to observe both what will best pay the breeder and be most sought for by the purchaser who intends to fatten. I may say, without discussing the why and wherefore, that I have generally found the preference given to anything that is cross-bred.

The majority of these crosses sent to our fairs and markets come from the North, and are generally the produce of a cow of a small breed and a shorthorn bull—their produce being an animal of greater size and earlier maturity than the dam, and still having a constitution that is able to withstand the rigours of the Scottish climate.

The Galloway or polled breeds of Scotland, as well as the Ayrshire, West Highland, and other horned varieties, are now so extensively crossed with shorthorns that the pure breed is very scarce, and good specimens are very rarely to be met with except at the shows of our Agricultural Societies. Our Eastern Counties

graziers used, some twenty or thirty years since, to draw the greater part of their winter beasts from Scotland; but now very few indeed find their way there, chiefly because our Northern brethren find it more profitable to feed them at home and send them fat to London and to other markets.

In the West of England—the home of the white-faces—cross-bred cattle are commonly seen at most of the fairs, as many of the small farmers who keep two or three cows manage to send them to the pure-bred bull of a wealthier neighbour; and I have been able to pick up very many useful steers bred in this way. The cattle met with in some parts of Wales and Shropshire called the "Shrop" are, I fancy, a cross between the native or Welsh breeds and the Hereford, and rare good fleshy beasts I have found them, much sought after by the butcher when fat, being liked better than the pure white-faced Hereford, particularly when they happen to have a mottled or smoky face; and I may here observe that the same rule applies to Hereford cattle as to cross-bred sheep—the more colour in their faces the better the butcher likes them.

The Devon breeders have perhaps done less than any others in crossing their cattle, which are admirably adapted for the soil and climate of their district, besides being much sought after for working purposes, an object for which a cross with the shorthorn would be prejudicial.

It is to the dairymen of Bucks, Derbyshire, Salop, and the West of England that we are indebted for many of the cross-bred animals now met with, for they look out for the cow that gives the most milk or butter, or promises to make the greatest quantity of cheese, quite regardless of her origin; nor in many cases are they much more careful as to the pedigree of the bulls, in consequence of their selling the calf when a few days old. But I find that there is now a growing desire among them to use a well-bred bull, whereby they will much improve the produce, to their own benefit as well as that of the purchaser. Where the heifer calves are reared to keep up the stock, a bull from a good milking family will soon alter the appearance of the herd.

The majority of the cross-bred cattle we meet with now-a-days partake more of the character of the shorthorn than anything else, so that to this breed belongs the credit of having done most towards supplying food for the million. No matter of what sort or amalgamation of sorts the cow may be, a cross with a pure shorthorn bull very rarely fails to make an improvement in size, quality, and fattening properties, if not always in the milking powers of the produce.

Many persons, I am aware, consider that cross-breeding is now-a-days carried to too great an extent, and predict that the

time is not far distant when our breeds will be so mixed that it will be difficult to distinguish one from the other. But there is no fear of this result; for the persons who chiefly resort to crossing are those who have up to the present time kept but a very inferior description of stock, which they generally fattened at as early an age as possible; so that the only change which has taken place as far as they are concerned is, that, from using a pure bull, they breed an animal that attains a greater weight at an earlier age than formerly. Such breeders, who are mostly the occupiers of dairy farms, will find that a few pounds laid out on a good bull will be an act of strict economy.

At Woburn Abbey, where a herd of from thirty to forty pure Herefords is kept, and still a large quantity of milk and butter required, I have found it quite impossible to improve the herd in milking and fattening or flesh-producing qualities at the same time, and have had often to sacrifice a very fine cow because she gave no milk, or others that were good milkers but unfit to breed a show ox. Finding out, then, that it was almost impossible to unite the truth of form and aptitude to fatten, according to our present standard, with a profitable dairy, I thought it desirable to keep two herds; one for breeding purposes (the dams only rearing their own calves) and the other for dairy purposes. Being a Norfolk man, and knowing what good milkers the polled cattle of that country are, I was led to try them, and have for the last three years had twenty of these cows, which I put to the Hereford bull, and fatten all the produce. These half-breds far exceed my most sanguine expectations, as they are much larger than the pure Herefords of their own age; and if they do not show quite so much quality, bear a very close resemblance to their sire, so that I look forward to their making some very good butcher's animals indeed, and am satisfied they will make quite as much money, if not more, than a pure Hereford of the same age.

At our annual sale of fat stock, held here every Christmas, I find if I have a crossed ox it invariably makes 2*l.* or 3*l.* more than the pure-bred ones; and the reason is that, the butchers tell me, they weigh so much better, are more fleshy, and give their customers greater satisfaction from the fact of the fat being better mixed with the lean. I have had cross-bred steers three years old making from 30*l.* to 40*l.* each, their dams being small Ayrshire cows and the sire a pure Hereford bull.

I have been often asked if I would go in any farther than the first cross between two distinct breeds. I think it best not to do so, as I have always found the produce of the cross-bred cow to be very inferior to herself, even if she has been put to a pure bull. They neither fatten so well nor do they attain so great a size at so early an age as the first cross; and therefore my plan

is to purchase my cows and feed off all their produce, both steers and heifers. That no mistake may arise, all the half-bred heifers are "spayed," by which means their value as fattening stock is increased. By this plan I now am enabled to get more milk from twenty cows, selected for their milking properties only, than could formerly be derived from double the number of Herefords; so that a considerable gain is realised, as my Hereford calves, being allowed to suck their dams for three or four months, are ready for the butcher much sooner than if brought up by hand.

I have of late years noticed that the shorthorn cattle shown at many of the Lincolnshire fairs are not so heavy-fleshed as they used to be; and a very old attendant at these fairs remarked to me that this was caused by the breeders going more for "pedigree" than formerly. I could scarcely at the time admit that this was the reason; but a little reflection told me that this might have something to do with it, for a straight back, nice rumps, and other catchy points are now more thought of than they used to be: many breeders of all kinds of stock looking too much to that which will please the eye rather than pull down the scale. This cause, then, may have led to our missing the heavy-fleshed crossed butcher's animals which we had been accustomed to see, and finding in their places beasts that showed every pound of beef they had about them.

I am an advocate for cross-breeding where a farmer is not in a position to keep high-priced stock, either from want of means or of proper shelter for them, since it is of no use for a farmer to try to improve his stock if they have to be left out in the fields all winter. In the Midland Counties many farms afford little or no shelter for the stock, so that they become stunted or diseased. In such localities nothing will tend more to improve the breed of our domestic animals than for landowners to erect suitable buildings for their accommodation. I do not at all see the benefit of crossing together the improved breeds, such as the Hereford or Devon and the shorthorn, as each race has its own specialities and uses that would be entirely destroyed by crossing. But no one who rides through the country can help observing that very many of the cattle kept cannot be said to belong to any pure breed; and to the owners of such as these I would say, you cannot do better than cross them with a bull of a pure breed, and will not have much trouble in finding one that would very much improve your stock at a very reasonable price.

Woburn Abbey Farm.

XXIII.—*Nitrification of the Soil.* Communication from M. P. Bortier, of Britannia Farm, Ghistelles, near Ostend, Member of the Royal Agricultural Society of England.

The necessity of the presence of calcareous substances in land has long been admitted by agriculturists; hence the custom of marling and liming has come down from very remote antiquity. The Greeks, the Gauls, and the Britons limed the land which they cultivated. Varro says that on visiting Germany he saw the labourers on the banks of the Rhine fertilising their land with white marl.

The celebrated Bernard Palissy, remarkable for his genius and misfortunes, highly recommended the use of calcareous manures. The experience thus acquired by time has not been thrown away; Puvis, in his Treatise on Manures, mentions the excellent results obtained by the agriculturists of the "Département du Nord," who have followed this custom for centuries.

For a long time, however, the real action of this mineral on the soil was but imperfectly understood, and the explanations which science furnished were at first but incomplete. The analyses of Berthier and Saussure, of Sprengel, Way, Payen, Nesbit, Liebig, Johnstone, and others, showed that the presence of calcareous substances was essential for plants, because these substances enter largely into their composition. Thus 10,000 lbs. of raw hemp take from the soil 882 lbs. of this matter, 8000 lbs. of dried clover absorb 152 lbs., and 5000 lbs. of wheat consume 34 lbs. It was therefore scientifically demonstrated that vegetation could no more dispense with lime than with nitrogen. This lime must, therefore, be furnished either by the soil or by manure, otherwise the crops are stunted, although there be an abundant supply of all the other elements.

Besides the above-mentioned fact, established by science, there is another which the Abbé Rozier, the great admirer of Arthur Young, has well explained, viz., the nitrification of the soil under the influence of this alkali: "Stratifying the dunghill with lime," says the Abbé, "decomposes the air contained in the manure and converts it into nitre, which gives to the soil an extraordinary fertility." *

In 1749 Piertsch, in a short treatise addressed to the Academy of Sciences at Berlin, which received their approval, states the circumstances which he thinks most favourable to nitrification. They may be summed up under four heads:—1st. The presence of calcareous matter; 2nd. Considerable porosity of the earth to

* Rozier, 'Course of Agriculture,' 1785.

offer a free passage to the air; 3rd. The putrefaction of animal or vegetable substances; 4th. Heat and humidity.

In 1779 De la Rochefoucault and Dolomieu observed that chalk became nitrified when in contact with the air. "I believe," says Dolomieu, "that the discoveries relative to the generation of saltpetre may teach us also the principles of vegetation. In order to bring land to its highest state of perfection, does not the farmer, by repeated ploughing, expose the different parts of the soil successively to the action of the air? Does he not mix with it animal and vegetable substances in a state of decomposition, and when the soil is too heavy and clayey, does he not apply calcareous marl to it? All these operations are calculated to produce nitre with the greatest success; and, in fact, there is no land in a high state of cultivation which does not yield nitre in a finely powdered state. From the above may it not be rationally supposed that one of the principles of vegetation—one of its primary causes of action—is this nitrous salt, the generation of which forms at present the object of scientific inquiry? The analogy between the means used for producing saltpetre and those used for bringing land to its highest state of fertility, might be continued still further; but this simple sketch will suffice as a groundwork for further experiments with this double object."

In 1778 Clouet and Lavoisier proved that the lime of Touraine and that of Saintonge nitrify very readily.

In 1782 Thouvenel competed for and gained the prize at the meeting of the Academy of Science in Paris; and he remarked that a basket of chalk, placed over blood in a state of putrefaction, produces a considerable quantity of saltpetre.

In 1784 Cavendish demonstrated that nitrification requires the contact of an alkaline solution.

In our own time Liebig, Boussingault, Barral, and Paul Thenard, have demonstrated that atmospheric air acting on a dunghill nitrifies it by degrees.

M. Boussingault has recently proved in a memoir read before the Academy of Science in Paris, "that a part of the organic matter contained in manures generates nitrates in the same manner as they are produced artificially."

The results which we here bring before the public are, therefore, only the application of scientific facts demonstrated by chemists, who, following the example of Davy, have brought the light of chemistry to bear upon agriculture.

This problem of artificial nitrification has been successfully solved by an experiment made at our farm—Britannia, near Ostend. The manure was placed on the top of the vault which contains the urine, and covered with a light roof of asphalt felt, supported by uprights made of fir. The manure was divided

into three equal parts: the first, consisting of farm manure, was consolidated in the usual manner by the feet of the stock, and regularly moistened with urine: the second was not trampled, but regularly moistened with urine, like the first; the third part was disposed and treated exactly like the second, except that each layer of manure was covered over with a light layer of slaked lime, in the proportion of two per cent. of the weight of the manure. The three heaps of manure remained in the aforesaid condition for three months. The piece of ground chosen for the experiment, that is, for the trial of the relative values of these manures, was clayey and of uniform quality: it measured a hectare (2½ acres), and was divided into three equal parts; to each part was assigned the same quantity of manure which was carted on to the ground in the beginning of May, at the rate of 32 tons per acre. On the same day these three plots were sown alike with summer rape.

The following are the results obtained during four years from these three lots:—From the first lot—farm-manure kept under cover, compressed and watered with urine, but not mixed with lime, according to the usual farm practice; and from the second lot—farm-manure watered with urine, not heaped up, produced the same result, viz.:—1859, summer rape, satisfactory crop; 1860, Australian wheat, fine crop; 1861, clover, two abundant cuttings; 1862, clover (cut once for an experiment), feeble vegetation.

The third lot—farm-manure watered with urine, not compressed, mixed with two per cent. of slaked lime, produced the following results:—1859, summer rape, vigorous growth maintained till the crop was ripe; 1860, Australian wheat, incomparably superior to the two neighbouring lots; 1861, clover, two crops, splendid; 1862, clover (cut once for a trial), growth continues little inferior to that of 1861.

The increase of produce obtained from the third lot may be valued at from 10 to 12 per cent. above that obtained from the other lots. This estimate is the result of carefully weighing the respective crops. We may then conclude from this experiment, that on clay soils recourse may be had to the easy and economical process of nitrification: that the effect of this process is to give to the manure a more energetic and durable action is evidenced by an increase in the produce of from 10 to 12 per cent.

What efforts have been made to produce artificial nitre-beds to furnish saltpetre for the manufacture of gunpowder! The time is come for agriculturists also to have their nitre-beds, not for the supply of destructive agents, but of a fertiliser which brings in its train abundance and prosperity.

Britannia Farm, Ghistelles, Ostend.

Note.—M. Venvinkeroge, a successful reclaimer of land at

Hasselt, mixes with his manure five per cent. of clay, rich in alumina, together with two per cent. of lime, considering that a similar result may thus be obtained on a sandy soil to that here recorded on a clay soil; the manure being left light and permeable by the air.

XXIV.—*Report of two Experiments in Sheep Feeding, undertaken by the Parlington Tenants' Club, near Leeds.*

The object of these experiments was by feeding sheep of different breeds *with an equal quantity of food*, to ascertain which breed was most profitable and best adapted to the soil of that locality. Separate Reports are given of the summer grazing on a grass and clover layer (the first stage of the trial), and of the winter feeding on swede turnips with cake, after a month's intermission of the competition, when all the lots were fed alike on turnips and rape without stint, to establish perfect equality of condition and a fair start.

The first experiment was made in a 16-acres field, divided into eight compartments of equal value, with 10 hogs in each allotment, except Nos. 2 and 7, the Banffshires and the Leicesters, in which there were 12 each. They were turned in on the 23rd May, 3 lbs. of linseed cake per lot per day was commenced on the 17th June, and increased to 6 lbs. on the 1st of August. The compartment No. 6 consisted of seven odd sheep, viz., one from each breed, and these had not cake. The members are quite aware that this Report is open to criticism, and are also reminded by its imperfections that first trials are rarely satisfactory. In justice to the patrons of the several breeds of sheep, it is only right to say that sheep of every variety were not to be procured in a proportionate condition; that Nos. 1 and 2, the cross from the Teeswater and the Cheviot, came to fold in good grazing condition, having been wintered upon the estate, whilst Nos. 3 and 4, the Lincolns, from Thomas Greetham, Esq., of Stainfield House, and the South Downs, from George Saville Foljambe, Esq., of Osberton, were fat, and had received every indulgence. No. 5, the Shropshire Downs, were in fair holding condition, but from two flocks, Messrs. Crane and another, the former taking the lead. No 7, the Leicesters, from Henry Hill, Esq., of Sledmere Field, (Sir Tatton Sykes), were in good market condition, having been brought out of his lot in the Leeds fat market; and No. 8, the Cotswold, from Edmund Ruck, Esq., were lean. With respect to the state of the pasture on the 4th Oct., the Banffshires, No. 2, had so eaten up their pasture on the 30th August, that it could not recover. Nos. 3 and

Table showing Increase from Summer Grazing.

Date of Weights.	1. *Cross from the Teeswater with the Leicester.* — Weight of 10 Hogs on the 8th June, 106 st. 13 lbs.	2. *Cross from the Cheviot or Banffshire with the Leicester.* — Weight of 12 Hogs on the 8th June, 124 st 13 lbs.	3. *Lincolns.* — Weight of 10 Hogs on the 8th June, 125 st. 9 lbs.	4. *South Downs.* — Weight of 10 Hogs on the 8th June, 97 st. 10 lbs.	5. *Shropshire Downs.* — Weight of 10 Hogs on the 8th June, 101 st. 6 lbs.	6. *Odd Sheep.* — Weight of 7 Hogs on the 8th June, 69 st. 7 lbs.	7. *Leicesters.* — Weight of 12 Hogs on the 8th June, 116 st. 3 lbs.	8. *Cotswolds.* — Weight of 10 Hogs on the 8th June, 90 st. 9 lbs.
1861.	st. lbs.	st. lbs.	st. lbs.	st. lbs	st. lbs.	st. lbs.	st. lbs.	st. lbs.
8th July . .	Increase . . 8 11	Increase . . 11 0	Increase . . 3 8	Increase . . 4 12	Increase 8 13	Increase 4 4	Increase 8 4	Increase . . 8 8
3rd August .	,, . . 5 2	,, . . 4 12	,, . . 3 9	,, . . 3 7	,, 5 10	,, 4 1	,, 7 8	,, . . . 4 6
30th August	,, . . 0 11	,, . . 4 7	,, . . 0 2	,, . . 3 2	,, 2 13	,, 2 0	,, 4 4	Decrease, 2 lbs.
4th October .	,, . . 8 5	Decr. 1 st. 10 lbs.	Decrease, 12 lbs.	,, . . 1 9	,, 3 0	,, 1 5	,, 4 5	Increase . . . 6 8
	Total increase 18 1	1 10 — 20 5	12 — 7 5	13 2	20 8	11 10	24 7	2 — 19 8
		Deduct decrease 1 10	Deduct decrease 0 12					Deduct decrease 0 2
		18 9	6 7					19 6
Total Weight on 4th Oct.	125 0	. . . . . . 143 8	. . . . . . 132 2	. . . . . . 110 12	. . 122 0	. . . 81 3	. . 140 10	. . . . . . 110 1

Odd Sheep, being one from each Class, having had no Cake, being the detail of Column No. 6.

Weight on 8th June	. . 10 6	. . . . . . 9 8	. . . . . . 11 8	. . . . . . 9 13	. . . 9 6		. . . 9 7	. . . . 9 1
8th July . .	Decrease, 4 lbs.	Increase . . 1 8	Increase . . 0 5	Increase . . 0 5	Increase 0 13		Increase 0 6	Increase . . . 0 13
3rd August .	Increase . . 1 2	,, . . 0 11	,, . . 0 5	,, . . 0 1	,, 0 5		,, 0 10	,, . . . 0 9
30th August	,, . . 0 7	,, . . 0 2	,, . . 0 4	,, . . 0 2	,, 0 7		,, 0 2	,, . . . 0 4
4th October	,, . . 0 7	,, . . 0 7	,, . . 0 1	Decrease, 1 lb.			,, 0 6	Decrease, 1 lb.
	4 — 2 2	3 0	1 1	1 — 0 8	1 11		1 10	1 — 1 12
	Deduct decrease 0 4			Deduct decrease 0 1				Deduct decrease 0 1
	Total increase 1 12			0 7				1 11
Weight on 4th Oct.	. . 12 4	. . . . . . 12 8	. . . . . . 12 9	. . . . . . 10 6	. . . 11 3		. . . 11 3	. . . . 10 12

and 5, the Lincolnshire and Shropshire Downs, had quite bared their ground, proving themselves like the Banffshires, great consumers, whilst the feed assigned to No. 4, the South Downs, was so good that it might have carried three if not four more sheep. No. 7, the Leicesters, had eaten close, and No. 8, the Cotswolds, not quite so close.

During the interregnum from October 4 to November 5, the following results were ascertained, which, though not part of the direct experiments, have an interest of their own, and give completeness to the investigation.

It was ascertained by weighing that in this interval—

	st.	lbs.		st.	lbs.
The Cross from the Teeswater gained	2	2	The Shropshire Downs gained	0	6
The North sheep gained	5	1	The Leicesters ,,	1	13
The Lincolns ,,	3	6	The Cotswolds ,,	5	8
			The South Downs lost	0	11

The sheep when purchased were shearlings, and had generally been fed upon swede turnips. The Lincolns were of the improved breed, a combination of Lincoln and Leicester blood.

The following table gives the results of the second part of the experiment:—

Description or Class of Sheep.	Live Weight of six Wether Sheep when Shorn on the 25th February, 1862.		Weight of Mutton when Slaughtered.		Weight of Tallow.	Weight of Wool.	Weight of Pelts.	Weights gained during the time of Feeding, from the 11th November, 1861, to the 14th February, 1862.					
								In Live Weight.		In Mutton.		In Wool.	
Lot.	st.	lbs.	st.	lbs.	lbs.	lbs.	lbs.	st.	lbs.	st.	lbs.	lbs.	ozs.
1. The Cross from the Teeswater	85	3	53	1	106	43	85	13	7	8	6	14	5
2. North Sheep . .	83	12	53	12	96	43½	83	12	11	8	3	14	8
3. Lincolns . . .	92	1	59	12	105	66	103	16	1	10	7	22	0
4. South Downs .	71	0	47	7	97½	28	65¾	11	13	8	0	9	5
5. Shropshire Downs	85	6	53	1	103	42½	91	15	11	9	12	14	3
6. Leicesters . . .	80	9	53	4	90½	44	78½	14	10	9	10	14	11
7. Cotswolds . . .	76	5	47	6	79	54	90	12	6	7	11	18	0

Description or Class of Sheep.	Value of the preceding Mutton and Wool.								Food consumed during the preceding time of Feeding.		Value of the Food, calculating Turnips at 6s. 8d. per Ton, and Linseed-cake at 10*l.* 10s.			Value of the Mutton and Wool added together.			Value of the Food deducted from the Value of the Mutton and Wool, showing the relative Value that one class of Sheep bears to another.		
	Of the Mutton.				Of the Wool.				Swedish Turnips.	Linseed-cake.									
	Price per lb.				Price per lb.														
Lot.	*d.*	£.	*s.*	*d.*	*d.*	£.	*s.*	*d.*	stones	lbs.	£.	*s.*	*d.*	£.	*s.*	*d.*	£.	*s.*	*d.*
1. The Cross from the Teeswater	6	2	19	0	18	1	1	6	978	300	3	8	10½	4	0	6	0	11	7½
2. North Sheep . .	6	2	17	6	17½	1	1	1¾	914	300	3	6	2½	3	18	7¾	0	12	5¼
3. Lincolns . . .	5¾	3	10	5¼	18	1	13	0	936	363	3	13	0¼	5	3	5¼	1	10	5
4. South Downs .	6½	3	0	8	17	0	13	2½	684	300	2	16	7½	3	13	10½	0	17	3
5. Shropshire Downs	6¼	3	11	10½	17½	1	0	7	924	300	3	6	7½	4	12	6¼	1	5	10¾
6. Leicesters . . .	5¾	3	5	2	18	1	2	0	877	300	3	4	8	4	7	2	1	2	6
7. Cotswolds . . .	6	2	14	6	18	1	7	0	926	300	3	6	8½	4	1	6	0	14	9½

All the sheep received alike ½ a lb. of oilcake per day during the winter feeding, with this exception, that the Lincolns during 42 days received an extra ¼ lb.; but this addition is charged to their debit in the tabular statement, as are the varying weights of turnips consumed by the several lots. The whole of the sheep were sold on the same day in Leeds Market, and the prices obtained fairly represent the state of fatness of the animals and the worth of their flesh.

Remarks on the above Experiment.

Mr. Fox, the President of the Parlington Club, to whom I am indebted for the preceding Report, has obligingly explained to me the basis on which the increase of meat and wool has been estimated in it.

The carcase weight and the live weight being ascertained at the time of sale, it was assumed that these bore the same proportion the one to the other as the *increase* in the carcase weight bore to the *increase* in the live weight, or in other words that as great a proportion of the live animal was saleable carcase at the beginning as at the end of the experiment. This assumption is evidently unfavourable, and probably not strictly correct; consequently the general economical results were really better than they are here represented; but it is not easy to put this statement into a more exact form, and the error, if any, affects all the lots nearly in the same manner.

It would seem that the proportion of meat to live weight at the time of sale was as follows:—

Lot 1. Teeswater	62·2	per cent.
,, 2. North sheep	64·2	,,
,, 3. Lincolns	65·0	,,
,, 4. South Downs	66·9	,,
,, 5. Shropshire	62·1	,,
,, 6. Leicesters	66·1	,,
,, 7. Cotswolds	62·1	,,

It is not improbable that in the previous November this ratio did not range much above 56 per cent. Greater precision, however, on this point could not have been obtained without slaughtering one or two average sheep out of each lot in November.

Any comparison between different breeds of sheep, to be complete, must be tested at different ages, and include every season of the year; for the more sensitive race loses ground on the approach of autumnal cold and wet, and when advancing by rapid strides in more genial weather, is in part only recovering that lost ground. The increase in the wool was thus estimated: when the sheep were killed, 300 days had elapsed since they were shorn; 100 of these had fallen within the period of the experiment; which therefore had credit for one-third of the

fleece. As the farmer who weighs his sheep, practically takes them to the scale as found in the field, with full stomachs and some dirt attached to the fleece, a record of the live weight of these lots under such circumstances may be serviceable as a contrast. These sheep were weighed in the field on the 14th of February; they then left the fold and went to be washed; from the 14th to the 25th they lay on clean dry ground, eating turnips but having no cake.

The following table shows the difference in weights at this interval:—

	Feb. 14. Unwashed, Unshorn, not Fasted.		Feb. 25. Shorn.	
	st.	lbs.	st.	lbs.
Lot 1. Cross from Teeswater	93	3	85	3
„ 2. North sheep	91	6	83	12
„ 3. Lincolns	101	3	92	1
„ 4. South Downs	78	6	71	0
„ 5. Shropshire Downs	94	9	85	6
„ 6. Leicesters	88	9	80	9
„ 7. Cotswolds	86	2	76	5

The first of these tables will probably be the most serviceable to the farmer, who sells his sheep in the wool from the field.

P. H. Frere.

XXV.—*On the Specific Gravity of Swede Turnips.* By Gilbert Murray.

Having had my attention directed by Professor Anderson's writings to the question of the specific gravity of the whole roots of turnips, and also that of the juice expressed from those roots, I have had these points investigated in relation to several experimental crops grown with different manure, and sown at different dates and different widths.

Dr. Anderson, in the 'Transactions of the Highland Society,' 1856, says that the specific gravity of the whole turnip cannot be accepted as indicating its real nutritive value, the proportion of air in the cells being one of the determining elements in such results; 2nd. That there is no constant relation between the specific gravity of, and the nitrogenous compounds in, the bulb; but 3rd. That such relation does exist between the specific gravity of the expressed juice and the nitrogen compounds and solid constituents; consequently we may rely upon this as indicative of the true feeding values of the several varieties tested. Thus the determination of the specific gravity of the entire bulb gives its keeping properties, and the specific gravity of the

expressed juice indicates at once the real feeding value of the specimen examined.

The whole of these crops were got up, cleaned, pitted, and covered with earth by the end of November, the price paid for cleaning, heaping, and covering, being 8*s.* 6*d.* per acre. I may state, in conclusion, that the crops are now being consumed; that it is quite the exception to find a single rotten turnip in the heaps, and that both sheep and cattle fed on them are doing well.

The farms on which those experiments were conducted are the property of the Right Hon. Lord Overstone, and occupied respectively by John Beasley, sen., and John Beasley, jun. They are situated at an altitude of 325 feet. The soil is a light sandy loam, resting on the ferruginous sand and sandstone of the lower oolite, variously tinted by the oxide and silicate of iron. These farms have been for many years managed on the four-course system; but within the last five years the five-course has been introduced with advantage, as far as regards the growth of the turnip crop, which consequently recurs less frequently. The wheat, after seeds, is followed by barley, which either receives a dressing of farmyard or artificial manures. At seedtime, this manure, not being fully exhausted by the barley crop, becomes incorporated with the soil, and is of immense benefit to the succeeding crop of roots.

The whole of the land on which the experiments were conducted grew barley in 1860. Some part of it was autumn cultivated, but the lateness of the harvest and the unfavourable weather retarded operations, and rendered the work incomplete.

Most of the fallow had been ploughed up to the depth of 6 inches before the frost commenced, in which state it remained to the middle of April, when it was cross-ploughed, rolled, harrowed, cleaned, &c., in the usual way. On the 15th of May, the soil being reduced to a fine state, we began to make 27-inch ridges, with the double-mouldboard plough.

On Plot No. 1, 20 one-horse loads of good bullock manure were laid and 3 cwt. per acre of Proctor and Ryland's turnip-manure was sown broadcast over the ridges after the farmyard manure was spread, and the ridges reversed and the whole covered in at once; the seed (3 lbs. per acre) was sown the same day.

The setting-out was done by men using 10-inch hoes, followed by boys to single out the plants. After this the horse-hoe ("Smith's"), drawn by one horse, and set so as to take two ridges at the same time, was used. They were again horse-hoed on the 21st of June, but this time with a common 5-tined hoe, with narrow points, and stirring the soil to a much greater depth. On the 30th of June they were carefully gone over the

second time with the hand-hoe, and all weeds along the top of the ridge between the plants cut out, boys again following, to pull out any double plants that might have been left the first time. From this date till the 20th of September, they were regularly horse-hoed at intervals of about ten days with the 5-shared hoe, stirring the soil the last time to the depth of 8 inches. On the 11th of November a portion of the crop was taken up, topped and cleaned, and the bulbs and tops weighed separately.

The weight per acre was 35 tons 3 cwt. of bulbs, and 2 tons 17 cwt. of tops, from 19,800 roots.

No. 2, the next piece, was sown the 18th of May, on land prepared in exactly the same way as No. 1, and received the same quantity of farmyard manure, but no artificial. The plants on this piece came up partially, the land not being sufficiently moist, consequently they came up at different times. They were not ready for the hoe till the 24th of June, when they were set out; the after cultivation was in every respect exactly the same as No. 1, only the number of plants per acre was considerably less, from being destroyed by insects.

This piece was tested on the 15th of November, and gave 28 tons 12 cwt. of bulbs, and 4 tons of tops, from 17,600 roots.

No. 3 was sown May 24th, on land fallowed and prepared the same as for Nos. 1 and 2. This piece was grown in competition for the 20*l.* cup offered by Proctor and Ryland, of Birmingham, for the best 5 acres of swedes grown with their manure only. The manure was sown broadcast, 6 cwt. per acre, and ridged in, the ridges being only 20 inches wide. They came up well, and were set out the first time the 24th and 25th of June. The narrowness of the ridges prevented the horse-hoe being used more than twice, and that at an early stage of their growth. This piece was early attacked by mildew, and suffered considerably, consequently the produce was greatly deteriorated in weight.

The weight on November 15th was 22 tons 6 cwt. of bulbs, and 3 tons 2 cwt. of tops, from 26,400 roots.

No. 4, a field of 22 acres, was sown from the 7th to the 14th of June on ridges 26 inches wide. The manure used was 20 (one-horse) loads of well-rotten farmyard manure and 2 cwt. of Proctor and Ryland's turnip manure per acre; the artificial was sown broadcast after the farmyard manure was spread, and the whole covered in together. Those sown on the 7th, 8th, and 10th were up well on the 14th, showing throughout the whole length of the field. We commenced setting-out on the 24th, the soil being very fine, with plenty of moisture; they grew remarkably fast. This crop was deeply horse-hoed at short intervals till

the middle of September, and maintained a healthy appearance throughout the whole of the season. On the 11th of November several pieces were weighed in this field, but so uniform was the crop that they varied only a few cwt. over the whole 22 acres.

The average weight was 25 tons 12 cwt. of bulbs, and 2 tons 15 cwt. 3 qrs. of tops from 19,800 roots.

Nos. 5 and 6 were two pieces of 5 acres each, grown with artificial manure alone; the manure was sown broadcast, and ridged 20 inches wide. The seed was sown on the 18th of June, came up well, and was set out from the 15th to the 18th of July. They were only once gone through with the horse-hoe, and that when the plants were very young. No. 5 received 6 cwt. of Proctor and Ryland's turnip manure, No. 6 had the same quantity of Lawes's superphosphate. Both pieces grew side by side, were treated exactly alike as to cultivation; both pieces came up equally well, and presented little difference in appearance till the time of getting up. Both pieces were weighed on the 15th of November.

No. 5 gave 18 tons 15 cwt. 3 qrs. bulbs, and 2 tons 15 cwt. tops, from 26,200 roots.

No. 6 gave 17 tons 15 cwt. bulbs, and 2 tons 10 cwt. tops, from 26,400 roots.

One root from each lot was then tested by Mr. W. H. Harris, F.C.S., Northampton, who found the specific gravity to be as under:—

	Specific gravity of bulb.	Specific gravity of juice.
Plot No. 1.	1·003	1·018
" 2.	·991	1·019
" 3.	1·101	1·024
" 4.	·0994	1·016
" 5.	·9846	1·016
" 6.	·9472	1·018

The seed from which all the different lots were grown was Perkin's Improved Swede, being a variety of Skirving's; but much finer in the neck than the original, of good quality, and a heavy cropper.

In spite of manuring and cultivation, if inferior seed be used, the end will be only disappointment. As the cultivation of the turnip extended, the raising of seed has become less attended to. The plant is by nature a biennial, requiring one season to perfect the bulbs, and another to perfect the seed; but since the demand has greatly increased, new systems of raising it have been adopted. In many cases the land intended for this seed bears a previous crop of hay, peas, potatoes, or in early districts, even of wheat. Consequently the swedes are not sown till the end of July, so that the roots from which the seed is raised will not be

larger than a hen's egg. May not some of the diseases to which the turnip has become liable be traced to this cause? At the same time there are many intelligent seed-growers who spare no expense to produce a first-rate article; and even if the farmer be charged by them an extra 3*d.* or 4*d.* per lb. for his seed, he will be amply repaid in the end.

The season of 1861 was unusually favourable for the growth of the turnip in this county, both as to temperature and rainfall, as the following table will show, in which the mean temperature of day and night, and the mean rainfall are given:—

Temperature, 1861.	Day.	Night.
May	55·38	41·19
June	64·00	50·02
July	65·48	52·00
August	65·29	53·29
September	59·96	47·30
October	62·00	48·09
November	43·00	32·19

Rainfall.	Inches.
May	1·17
June	2·15
July	3·60
August	0·18
September	1·80
October	1·22
November	2·62

Overstone Farm, January 26*th*, 1862.

XXVI.—*Statistics of Live Stock and Dead Meat for Consumption in the Metropolis.* By Robert Herbert.

Notwithstanding that the Metropolitan Cattle Market has been extensively supplied with beasts during nearly the whole of the past six months, and that prices have fluctuated to some extent, the beef trade has continued in a healthy state. Our prices, however, do not appear to have met the views of the breeders of stock on the Continent, as we find that only 6195 beasts were received from abroad in the period here indicated, against 12,422 head in the corresponding period in 1861. The fact appears to be that, owing to the enormous drain made in the two previous years, both live-stock and dead meat are now very dear in Holland, and that, consequently, there is little or no profit on shipments to this country. Whilst the foreign importations have fallen off, home-supplies have increased considerably; indeed, we are justified in saying that fully five-eighths of the beasts derived from Norfolk and Scotland since the 1st of

January have been considerably above average quality. And these remarks may be applied not only to the crosses, but, likewise, to the pure breeds. The improvement in the weight and condition of the beasts, whilst it has considerably checked an upward movement in the prices, has enabled the poorer classes to obtain prime meat at a moderate outlay. Even those who purchase on Government account have intimated that, for some time past, they have only bought prime animals, having found them much cheaper than those of a second-class character. That the consumption in London has been enormous—especially since the opening of the International Exhibition—is evident; and had it not been for the great distress which unhappily prevails in the manufacturing districts, arising from the cotton famine, prices would have risen much higher. The increase in the supplies shown in the great cattle-market has, in some measure, arisen from a portion of the stock originally destined for the Manchester and Leeds markets having been forwarded to London. From the same cause Ireland has sent more beasts to London than during the last three years, and the receipts from various parts of England show an excess of nearly 3000 beasts.

It is satisfactory to observe that very few losses have been sustained from disease in any parts of England. In some districts some of the stock have suffered from lameness; but, with very few exceptions, the hoofs have been preserved. The great abundance of grass has, no doubt, been a most important feature in cattle-grazing and sheep-feeding; whilst the large quantity of hay secured last year, though in many instances in inferior condition, has checked a large outlay for artificial food. In noting particularly the Irish supplies, we may observe that about one-third of them have shown signs of crossing with some of our best breeds; nevertheless, their weight and condition have fallen short of some previous years, and they are a little out of favour. Scotland—the arrivals from which have amounted to 9794 head—has forwarded about 4000 crosses and nearly 5000 pure Scots—the former in wonderfully fine condition, quite as good as in most former seasons. The commencement of the period for the receipt of stock from Lincolnshire, Leicestershire, and Northamptonshire, has been marked by the arrival of about 1500 shorthorns, and it is stated that large numbers will reach us in the course of the year. It is admitted, however, that the supplies ready for transmission are comparatively moderate, many of the graziers having kept their stock in the fields somewhat longer than usual, owing to the great abundance of keep. The following return shows the quarters from whence London derived its supplies of beasts in the first six months of the present and five previous years:—

"District" Bullock Supplies.

	1857.	1858.	1859.	1860.	1861.	1862.
Northern Districts ..	..	4,000	4,000	4,000	4,700	400
Eastern Districts ..	60,500	66,890	7,460	63,520	64,060	68,420
Other parts of England	14,490	14,560	19,090	21,420	17,700	20,290
Scotland	8,860	8,456	10,030	5,033	8,712	9,794
Ireland	2,700	4,820	2,217	1,477	256	2,545
Foreign	9,238	5,649	7,580	9,058	12,422	6,195

Amongst the foreign beasts exhibited were about 500 from Spain. Although large and of good symmetry, they have "died" badly, or, in other words, they have yielded only a limited quantity of internal fat. The prices realised for them varied from 19*l.* to 26*l.* per head, which, after allowing for freight, charges, &c., have left little or no profit for the shippers. It may, therefore, be doubted whether we shall draw any large quantity of stock from Spain for some time, especially as France is still a large buyer in that country.

Both as regards number and quality the arrivals of home-fed sheep have been considerably on the increase. The weight of most breeds has, too, been in excess of 1861; and the result is, that prices have given way. They are, nevertheless, somewhat high—the best Downs being now worth 5*s.* per 8 lbs., though this is 6*d.* per 8 lbs. less than last year; but the fall in the inferior breeds had been confined to 2*d.*—a proof that the supplies have not been much, if anything, in excess of the demand. Foot-rot has been by no means general, but the damp state of the pastures, caused by the excessive rainfall of the last two months, is unfavourable for the sheep. The arrivals from Holland, taken as a whole, have not equalled those of 1860 or 1861. A few of them have realised good prices, but the inferior stock have sold on lower terms. At one period there was a decided improvement in the imports of sheep from Germany *viâ* Hamburg. Most of them had been crossed with our Downs and Leicesters, and the whole were readily disposed of at from 27*s.* to 35*s.* each. But the cross-breeding had evidently been limited in extent, for the sheep lately received from Germany have been in poor condition, and the rates obtained for them have ranged from 19*s.* to 25*s.* each, chiefly for grazing purposes. Our statistics of sheep and lambs show an increase in number compared with 1861 of 27,022; but a decrease of 30,358 head compared with 1860, and of 37,030 compared with 1859. We understand, however, that greatly increased supplies of dead meat have been received both from Scotland and various parts of England at Newgate and Leadenhall markets.

The low range in the value of rough fat, viz., 2*s.* 4½*d.* and 2*s.* 5*d.* per 8 lbs., consequent upon the inactive state of the tallow trade, has, of course, had considerable influence upon the prices of live-stock. In 1860 rough fat was worth as much as 3*s.* 2½*d.*, and last year it realised 2*s.* 8*d.* per 8 lbs. The decrease in the price must be chiefly attributed to the increased consumption of gas, naphtha, &c., in this country; and our impression is —seeing that about 110,000 casks of tallow will be shipped from St. Petersburg this year, and that both beasts and sheep are likely to reach us in good condition—that there is very little prospect of fat becoming much dearer than it now is.

The clip of wool has proved the largest and best on record—not only in England, but also in Ireland and Scotland. This is an important matter for the flockmasters, but it may be doubted whether wool will rise in value, because the demand for continental use is inactive, and enormous quantities of colonial wool, expected to comprise about 95,000 bales, are now on hand for the next public sales. As yet, very little of the new clip has changed hands.

The past has been by far the most profitable lamb-season ever known. Although the market has been well supplied with lambs from various parts of the country, the trade has been active and the price good. At one period the best Down breeds were worth as much as 9*s.*, and until recently they have commanded 8*s.* per 8 lbs. At present, however, the inquiry is heavy, at from 5*s.* to 6*s.* 4*d.* per 8 lbs. The number of lambs exhibited has been rather more than an average. Down, half-bred, and Dorset lambs have mostly appeared in good saleable condition. The lambs received from abroad—about 3600—have been poor in condition, and sold at low rates. The veal-trade has ruled very quiet, at prices ranging from 4*s.* to 5*s.* 6*d.* per 8 lbs. The imports of calves from abroad have rather exceeded 7000; consequently, only about 1200 English have been shown. There has been a steady demand for both English and foreign pigs, at full quotations. Those from the Continent have been very deficient in quality, but those from Ireland have improved in condition.

Supplies of each kind of Meat Exhibited and Sold during the first Six Months of the following Years:—

	1857.	1858.	1859.	1860.	1861.	1862.
Beasts	112,309	111,592	113,373	114,702	109,812	116,735
Cows	2,682	2,917	2,977	2,904	3,005	3,054
Sheep and Lambs	536,790	588,758	668,702	662,030	604,650	631,672
Calves	8,420	8,878	7,272	9,515	6,560	8,259
Pigs..	13,240	13,096	14,869	14,201	15,952	17,407

Average Prices of Beef and Mutton.

	1857.	1858.	1859.	1860.	1861.	1862.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BEEF:—						
Inferior	3 2	3 0	3 2	3 6	3 4	3 0
Middling..	4 0	3 10	4 0	4 6	4 4	4 0
Prime	5 0	4 6	5 0	5 6	5 0	4 8
MUTTON:—						
Inferior	3 10	3 2	3 4	3 10	3 8	3 6
Middling..	5 0	4 2	4 8	5 2	5 0	4 6
Prime	6 0	5 2	5 10	6 2	5 10	5 4

The dead markets have been well supplied with each kind of meat, in which a good business has been transacted. Beef has sold at from 2*s.* 8*d.* to 4*s.* 6*d.*; mutton, 3*s.* 6*d.* to 4*s.* 10*d.*; lamb, 4*s.* 8*d.* to 7*s.* 4*d.*; veal, 4*s.* to 5*s.*; and pork, 3*s.* 10*d.* to 5*s.* 4*d.* per 8 lbs. by the carcase.

As regards the future course of the trade a few observations are necessary. That the country has recovered from the effects of a great scarcity of stock in 1860 must be obvious from a perusal of our statistics; nevertheless, and although the consumption of meat in the manufacturing districts is likely to be small during the continuance of the cotton famine, it is not equally clear that production is in advance of consumption. We are of opinion, therefore, that prime stock will command steady currencies for some time; but, on the other hand, there appears to be room for a decline in the value of inferior beasts and sheep. There are, however, two features in favour of firm quotations, viz., the great abundance of money for commercial purposes, and the healthiness of most branches of trade, except those connected with the production of cotton goods.

4, *Argyle Square, St. Pancras, London.*

XXVII.—*Report of the Stewards of Stock at the Battersea Show.*

A YEAR so exceptional in its character hardly admits of comparison, except in some cardinal points, with any of its predecessors. In order to make the meeting in strict accordance with the "World's Fair," of which it formed part, old classes were subdivided, and new ones formed; and if the pecuniary success of this twenty-fourth anniversary did not fulfil expectation, the entries in the English classes prove that the exhibitors quite caught the spirit of a great occasion, which induced Scotland to carry her national gathering 300 miles over the border, and brought cherished favourites—the flower of the herd—from the pastures of Normandy and the slopes of the Alps.

The catalogue contained 1986 entries, of which 183 must be credited to the foreign, and 238 to the Scottish departments; and the whole was contributed by 535 exhibitors. Unusually few stalls or pens were vacant, and the trying ordeal of keeping the animals for nine or ten nights under canvas, was rendered light by the remarkably favourable weather. Public judging was introduced for the first time; and the keen interest with which the process was watched, both by the members of the Society and the public (of whom 1146 paid the sovereign admission), went far towards showing how highly this new privilege is valued.

In consequence of the limited space at command, rings for the cattle had to be dispensed with. It is to be hoped, however, that in future years the system will not be thus crippled in its operation; and it may be well to consider a suggestion which was made to us, that the sheep and pig sheds might each be arranged so as to form the four sides of an oblong space, and thus prevent that proximity of the spectators to the judges, which cannot be avoided, even with a large body of assistant-stewards, when the animals are judged between the rows.

The Short-horn entries numbered 250, which is an advance of 20 per cent. upon those at Leeds; the Herefords rose from 38 to 97; and if the Devons did not form a "juicy red line" of 125, as at Exeter, a grander lot of 66 has been rarely brought together.

In point of horses, it had not been anticipated that a meeting in Middlesex could vie with one in Yorkshire, but the fresh inducement which was given to the owners of Suffolks restored the balance, and the 284 entries (inclusive of 23 Shetland ponies and 27 Clydesdales) were 30 above those of last year. The English sheep entries were 576, as against 359; and while the Leicesters (73) were only 7 in advance, the Southdowns (96) were more than doubled, and the Shropshires (95) were the same number within 1. The large money-vote for the encouragement of other long and short woolled sheep was well responded to: in the one instance by 161, or 100 more entries; and by 121, or nearly two-thirds more, in the other. The pig entries increased from 115 to 194.

Professor Simonds reports that there were very few disqualifications among the cattle, sheep, and pigs; one sheep in the Hampshire and West Country Down class was put aside, in consequence of having a defective hind limb, from atrophy of the muscles, although otherwise a very excellent animal; 7 pens of pigs were disqualified for exceeding the age stated, and it is a singular circumstance that 3 of them belonged to the same person. No cattle were disqualified, as the few defects observable were not of sufficient practical importance to warrant such

a step; and it was gratifying to find that the evidences of scrofula—which were so frequent a few years since among the Devon cattle—were not to be found in the Battersea classes. We learn from Professor Spooner that although several certificates had been given in a very lax way, he has to report a very material diminution of disease—especially hereditary disease—among the horses at Battersea, as compared with those at Canterbury or Leeds. There were only 3 cases of ophthalmia, and the roaring was principally confined to the cart-horses—which were much freer than usual from ossified cartilages. Among the Suffolks especially he found several cases of synovial disease of the hocks; and the Clydesdales were very ridgy about the coronets, and rather brittle in their feet (owing to the use of too many nails in shoeing)—defects which he believes to become hereditary in time. Four of the thorough-bred sires were disqualified, 2 for being whistlers, a third for spavin, and a fourth for curbs on both hocks. Of the hunter sires, 5 had to be set aside, viz., for ophthalmia, contracted fore-feet, whistling, and flat fore-feet, coupled with chronic disease of the frog, and sand-crack. This much will suffice to indicate the general nature of the disqualifications, without going *seriatim* through the classes.

Those who witnessed the show at the *Palais d'Industrie* in 1856, or the recent International Easter one at Poissy, can judge of the strength of the French herds when it is adequately put forth on their own soil. We had not at Battersea the long white and cream-coloured lines of Charolais; the dark-red Salers; the dun and white-faced Comtois; the lion-tawny Aubracs; the bay, white, and grey Algerians; the barley-coloured Limousins and Garronais, with their great offal, and collar power—but still the few which crossed the Channel, when joined to the Swiss, with all their picturesque accessories of collar-bells and herd music, gave a right pleasant international tone to the gathering. Various causes operated to prevent the French part of the Show from being so extensive as His Majesty the Emperor and his agricultural representative, M. St. Marie, could have wished. Still every facility was given by the Imperial Government; the cattle were conveyed by rail, free of all expense, to the sea-coast, and the South-Eastern and South Coast railways were alike liberal in their arrangements. Two of the Charolais breed were brought over—a bull and cow—level, but hard to the touch; yet fair specimens, the bull more especially, of a tribe more renowned for beef than milk. There was also one greyish-brown Garronaise, and a few specimens of the sturdy brindled and white Normands, to which Paris looks for its milk supplies; 1 or 2 yoke-bulls from the spurs of the Pyrenees, with coats like dull-red gold; and an excellent class of Bretons, to which England contributed largely.

Cows of this breed were first shown at the Chelmsford Meeting; and Mr. Baker's beautiful Gold Medal bull "Prince" and 3 heifers of the sort were commended in a General Class at Leeds. The prizes were generally awarded to the larger specimens, which are not so much fancied for their milk in toy dairies as the smaller ones, from the more mountainous parts of Britanny, where the pasture is scanty. Thirty-six inches is about the fashionable standard for cows; and the price, which at first ranged from 20*l.* to 24*l.*, now goes as low as 13*l.* Black and white is the orthodox colour, but the red and whites—of which there is scarcely 1 in 20—are eagerly sought after. They are so docile, and bear tying up so well, besides living on 10 lbs. of fodder a day, that the Bretonne cow is not unfrequently reckoned as part of the luggage of families coming up to town for the season. The fine horn—like that of the Alderney, but thinner, and tapering away gradually from the head—is looked to as an indication of milking properties; and so are the lines inside the thighs, which should branch out wide, and run on at an equal distance down to the udder. The oval marks higher up and close to the tail give a promise of butter; and the buff tinge and thick soft skin of the udder are said to be an infallible sign both of butter and milk. These cows have been known to hold their milk for 18 months after calving, and occasionally give as much as 6 or 7 quarts per day with a first calf.

The Dutch cattle, which claim to be among the best dairy cows in Europe, and the parent stock from which our shorthorns sprang, did not show in much force, owing to the prevalence of the *febris pecorum aphtosa* (foot and mouth disease), which had been unusually severe in Holland; but the Swiss were a host in themselves. Although the Swiss Government, which took a deep interest in the matter, applied to have this stock divided into three classes, it was finally determined to form only two—the "Swiss Brown" and "Swiss Coloured." The bulls were of all types and sizes, and were carefully scanned for their milk-marks; and M. Adrien Ecoffey's prize cow was an especially grand specimen of her kind. One of the judges writes thus of them:—

"Being appointed to these classes in conjunction with Herr Karlen and Herr Geusch, both eminent Swiss agriculturists, I beg to say, that according to the opinion of these gentlemen, in which I entirely concur, the show of stock in this class did great credit to Switzerland, both in point of numbers and excellence. The entries, both of bulls and cows, were far more numerous than those of any other class of foreign stock, and the branded cross on the near quarter of many animals, denoted prizes taken at home. The Bernese or dun-coloured breed included several animals of great merit, and the oxen are not to be excelled as workers, but they are not destined to improve the 'Roast Beef of Old England.' The spotted class varied exceedingly in size

and shape, but though none of them approached our standard of perfection, yet it is probable that the whole class if brought to the test of the pail would have distanced an equal number of Shorthorns, Devons, or Herefords, taking the pick of the show-yard. In short they are first-rate dairy stock, and remarkable for their hardy constitutions, and I trust that they found sufficient favour with our dairy farmers to reward their enterprising owners for the trouble and expense they incurred in sending them over."

"Panard de Courville," an active iron-gray of the pure Percheroune breed, was the sole representative of foreign live-stock among the horses: and the Augeron, Normand, and Perigourdin pig-breeds yielded their claims for representation to a large Craonnais boar, with the ears and snout of a truffle-hunter. The sheep classes, with the exception of two or three pens of Chinese, more famed for their prolific powers than their looks, were made up of pure and cross-bred Merinos. There were none of the Dishley-Merinos, whose early maturity, when crossed with the Leicester, made such a fine feature at Poissy in 1857. The French Merinos are valuable for their size and mutton, as well as their wool, which weighs from 8 lbs. to 18 lbs. in the grease. Those exhibited were of good fair form, "up to the eyes and down to the toes in wool," which is inferior to that of the Spanish Merino, the ewes of which race were small and deficient in constitution. Those from Saxony were not equal in size to the French, though very famous for the quality of their wool—a consideration which had to yield to that of superior form when an umpire was called in to decide between the English and Saxon judges. Mr. Sturgeon of Essex and Mr. Dorrien of Sussex exhibited several pens of Merinos bred in England, which could not therefore compete for prizes. The pens belonging to the former gentleman were highly commended, and those of the latter were commended.

Although, owing to its proximity to the Border, the meeting at Carlisle had rather a Scottish character, that country never furnished a really component part of the English Society's Show until this year. It was suggested that such unions might be repeated, especially when the Royal English Society holds Meetings in the North; but this proposition does not seem feasible, as the charter of the Highland Society, as well as the general feeling on the point, would hardly admit of one meeting being merged into another, except under the exceptional circumstances of this year, when both agriculturists and herdsmen were anxious to have a trip to the International Exhibition. The arrangements of Mr. Hall Maxwell, the Secretary of the Highland Society, for the servants in charge of the Scottish stock, are especially worthy of record. These men, who numbered 120, were all strangers to London, and it was necessary to keep them under proper control, and well in hand. With this

view they were placed under Mr. Maxwell's charge, and encamped close to the yard, in marquees hired from Messrs. Edgington, and fitted up with new beds and bedding, kindly issued from the Tower by Lord de Grey. A certain number of them were on duty every night, and each day they were taken in detachments, at the Highland Society's expense, to the Exhibition and the Crystal Palace. The only stipulation with their employers was, that they should be sent up well dressed in Scottish materials, and certainly a more respectable looking and better behaved body of men were never brought together.

Of the cattle classes the judges speak thus:—

"*Polled Aberdeen and Angus*, Class I.—The first prize was awarded to Mr. Lyell's 'Prospero,' a bull of very fine quality, but small in size; and the second to Earl Southesk's 'Druid,' perhaps in some respects better, but his age (8 years) was against him for breeding purposes; as a class they made a fair show. The first in Class II., Mr. Pierson's 'Young Alford,' and the first and second in Class III., Mr. McCombie's 'Rifleman,' and Mr. Lyell's 'Commodore Trunnion,' were good, but neither class was above an average. The cows were very good, I have not seen better; Mr. McCombie here took first prizes with his 'Pride of Aberdeen' and 'Charlotte.' Mr. McCombie was again first and second with his two year-old heifers, and Earl Southesk third, all with good animals in an average class. His Lordship was first with 'Rosetta' in Class VI., which was certainly not above an average. *Polled Galloways*, Class I., Mr. Beattie's 'Mosstrooper the 3rd,' a bull, first-rate of his kind, gained the first prize against three good animals. There was no entry in Class II., and only two in Class III. I have seen better animals than Mr. Beattie's 'Bridesmaid' by 'Mosstrooper 3rd,' and the Duke of Buccleuch's 'McGill,' the first and second in the Cow Class; the first and second heifers in Classes V. and VI. were pretty fair. *The Highland* cattle were not numerous; but, with some exceptions, of considerable merit; as a class the Aged Bulls were particularly good, and the first prize one, Mr. John Malcolm's 'Duntroon,' seldom equalled. The two bulls exhibited in the other classes were only of ordinary quality. I expected to have found the Cow Class better, but I have seldom seen finer animals than the three-year-old heifers, and I consider the Marquis of Breadalbane's 'Prosaig' the best female in these classes, in which Mr. John Malcolm gained two, and the Marquis of Breadalbane three of the first prizes.

"*The Ayrshire Stock* were fairly represented in all the classes, except, perhaps, Class III., and more were exhibited than I expected. The Duke of Hamilton's first prize bull 'Sir Colin' is as fine a bull of his kind as can be found anywhere, and the first prize two-year-old bull, Mr. John Stewart's 'Carnal' is also a good animal. The Duke of Athole's first prize cow 'Colly Hill,' although advancing in years, is a very fine one, with great capacities for the pail. This cow was, with her neatly-dressed milk-maid, one of the special attractions of the show, and milking time was most keenly looked for by the visitors. The Dukes of Athole and Hamilton and Mr. John Stewart took all the prizes in this class.

"*The Black-faced Sheep*, the principal prizes for which were awarded to Messrs. Drife, Sandilands, and Pollok, made up an excellent show, quite above the average of any I have seen. Mr. Pollok's first prize pen of old ewes were remarkably good, and in the other classes the competition was very equal."

The Cheviot classes, which had no entries from Ross and Sutherlandshire, were not very numerous, but pretty good as a whole. Mr. Thomas Brydon's first prize old ram was a very superior one, and well deserved his honours, and so did Mr. Borthwick's first pen of ewes.

In the Clydesdale classes the show of stallions was not numerous, as many of them had not finished their season. The judges report that the Duke of Hamilton's "Sir Walter Scott" and Mr. William Kerr's "Champion," the first and second in Class I.; Mr. Stirling's "Nancy," the Duke of Hamilton's "Princess Maud," and Mr. Stirling's "Jess," the first, second, and third in Class IV.; and Mr. Findlay's "Bessie Bell" and "Mary Gray," the first and second in Class V., were first-class specimens and all of good symmetry. Of "Sir Walter Scott," 'Nancy," and "Princess Maud," they remark that they had "great style in action," but that "Jess" had "bad action with her forelegs." Mr. Kerr's mare "Rosie," which took the first prize in Class III., is noticed as "good through the heart and round the loins for a mare out of condition, and the bone and hair on the legs good." Another judge thus speaks to the merits of the classes:—

"Aged Clydesdales were superior, particularly the first prize horse; the three winners of prizes in Class I. were what I should term extra specimens of the Clydesdale horse, but the unsuccessful entries were not good. In Class II. for entire colts, Mr. Mowbray's first prize colt was good at the age, but all the others were below the average, and in many respects inferior. The mares with foals at their foot in Class III. were fair specimens of the breed, but mares in foal, Class IV., quite surpassed them as a whole, and were, in my opinion, the best class of all the Clydesdales at Battersea; the first and second fillies in Class V. were also superior, and all in this class rather above the average."

To show the strength of Class V. it may be mentioned that Mr. Stirling exhibited five mares in it, of which the only one that missed a prize or a commendation was the 12-year old "Snip," who, in Mr. Douglas of Athelstaneford's hands, has won first prizes at the Royal Agricultural and Highland Society's Meetings, and still looks as sound as ever on her legs. Among these five there was a considerable diversity of colour and type, and they varied in height from sixteen hands to sixteen three and a quarter.

Cattle.

Turning from the Foreign and Scottish to the English part of the Show, we find it opened by an array of 250 shorthorns,—138 males and 112 females. Perhaps there were not so many "plums" among them as at Leeds (where Captain Gunter's "Duchesses" were so prominent), but the female classes con-

tained a greater amount of average excellence. The subdivision of the Aged Bull class was successful in every way, as the 3-year-old bulls formed one of the most interesting classes, and the two included 53 entries as against 38 last year. In the Aged Bull class, the second and third at Leeds only shared the general commendation, and a highly-commended one now took second honours. "As a lot, they had fewer rough points, but still there was not one tip-top bull" to give character to the class. Though not what is technically termed "a show bull," the American-bred "Lord Oxford," had some grand points about him; and the filling-in of the fore-ribs of "Cœur de Lion," who girthed 9 feet 7 inches, was worthy of the last Smithfield Gold Medal ox. The Scottish luck began with Mr. Stirling's "Forth," in the 3-year-old Bull class; and two firsts, a second, and a third constituted their share of the Shorthorn prizes. It was also specially observable that the owners of small or more recently established herds contended very successfully with some of the most formidable exhibitors of bygone years. Still the peculiar feature of this part of the Show was the winning of the gold medal for the best male animal in the classes by a bull calf, "whose wonderful maturity and careful preparation have perhaps never been equalled."

Of the Bull classes, one of the Judges reports thus :—

"In Class I. there was certainly nothing very good, but there was a great improvement in this respect, that none of the class were unable to work. Mr. Wood's 'Lord Adolphus,' to which we awarded the first prize, although rather flat on his sides, and thin across his shoulders, was by far the best in quality, and in my opinion best adapted to produce good stock either for breeding or the butcher. The second, Mr. Langston's 'Lord of the Harem,' was a very useful bull, and more compact, but not of such good quality as the first; the third, Messrs. Hosken's 'Prince Frederick,' being older, was well finished, but deficient in quality and hair. The class altogether was useful, and none of them were overfed."

With respect to this decision, which was unanimous, another Judge writes—

"We were not to take into consideration the present value of the animals to the butcher, but the Society's object of promoting the cheapened production of the best meat, regard being had to those animals in a breeding state most calculated for that object. 'Lord Adolphus' had the best head and best fore-quarters in the class, that point of all others being most difficult to get in all male breeding animals, and his forequarters, which were the type of what they should be in a breeding animal, were worth a shilling per stone more as a carcase than those of any other bull in the lot."

The first report proceeds thus :—

"Class II. was a very good class generally; Mr. Stirling's 'Forth,' which got the first prize, was, if anything, too fat, which rather put him out of shape; the second, Mr. Ambler's 'Gamester,' was a particularly nice bull, but short of condition; and the third, Mr. Balfour's 'Great Seal,' useful, but nothing particular as to quality. In the remainder of the class there were

many useful bulls. In Class III. there was nothing very good. The first prize, Mr. Marjoribanks's 'Whipper-in,' had bad hind-legs, but a little better quality, though not such good symmetry, as the second, Colonel Townley's 'Royal Butterfly 10th;' and the third, Mr. Ambler's 'Windsor Augustus,' was a neat bull, short of condition. Class IV. was by far the best, as Mr. Jonas Webb's 'First Fruit' was the richest specimen I ever saw at the age, both as regards symmetry and quality. Mr. Pawlett's 'Hopewell,' and Mr. Robinson's 'Jericho,' which received the second and third prizes, were good, and there were at least ten more fit to take a prize."

In the female classes, Mr. Richard Booth had the good fortune to win two first prizes and the gold medal with the only animals he brought to Battersea. His gold-medal cow, "Queen of the Ocean," sister to "Queen of the May," "Queen Mab," and "Queen of the Vale," is "a short-legged, well-formed, and useful animal, and by far the best female shorthorn in the yard, with shoulders and hocks as near perfection as possible. Lady Pigot's 'Pride of Southwicke' was second, easily enough," this being the third time in succession that her ladyship has gained one of the cow prizes; and Mr. Jonas Webb's "Lady Elizabeth Yorke," "not a good one, and overfed," came third. In point of massiveness and breeding qualities, this gentleman showed a remarkable lot of five in this class. Their united ages were under 24 years, yet, without any twins to swell the number, they had bred 14 calves: one was within 3 and another within 7 weeks of calving, two had calved in April, and the time of the fifth was up in September. "Maid of Athelstane," "Wood Rose," and "Claret"—all winners at the Society's meetings—were now unnoticed, and no commendations of any kind were bestowed. One of the Judges thus speaks to the point:—

"With the exception of Mr. Booth's cow, I did not think there were any really first-class ones, and in many instances they were very objectionable in one very important point, I mean as regards their milking. I do not find fault with the small quantity of milk they were likely to give, but a great many otherwise good animals had udders of such ugly shapes, that a milch cow-dealer would not have them at any price. Now in my opinion, a cow with an udder that appears to be full of large stones cannot be the proper animal to breed from. It is a pity that the breeding animals should be shown so very fat, and I hope it was noticed by the public that the very fat ones did not in all cases obtain prizes, but only when in our opinion they would have done so had they been less covered with flesh."

He adds—

"We may decidedly call the show of shorthorn females good, especially as regards the younger heifers; the cows were not so good, two-year-olds about the same, and yearling heifers better, than at Leeds. The Duke of Montrose's 'May Morn,' the winner in the two-year-old heifer class, is a good shorthorn in style and quality; Mr. Lane's 'Maid of Athens' (the second prize) is a nice even-grown heifer, and Mr. Douglas's highly commended 'Queen of Athelstane' has good flesh, deep ribs, and a beautiful loin, but is over fed, and with bad shoulders.

"In the yearling heifer class, Mr. Atherton's 'Lady Barrington 6th,' a

nice level heifer, which looks older, and would look very different if she was poor, was highly commended, and eight others out of the forty-four were commended. In this fine class, Colonel Townley with his 'Frederick's Faithful' was second to Mr. Booth's 'Queen of the May 2nd,' a real shorthorn, but not so good as she might be in the forerbs and shoulders. Lord Feversham's 'Barefoot,' the winner of the third prize, has good quality, but not a nice head, and looks like making a cow; and the flesh of Mr. Marjoribanks' 'Winning Witch' was too coarse for a female. There were several nice animals in the class, but too many of them over-fed and without nice quality; and, moreover, one or two of the best had not the hair of a shorthorn."

The winner in the Calf class, Mr. Middleborough's "Lady" was "on a high leg, and looks like making a cow; but is long in the face, and not very good in the shoulders." The second prize calf, Mr. Douglas's "Pride of Athelstane," "had nice quality of flesh as well as two good ends, but was hollow on the loins;" and the Judges pondered long before they conld decide to prefer Mr. Robinson's "Claret Cup" for the third prize to Lady Pigot's "Castianira," which was highly commended. Others in this class are judicially mentioned as "having capital coats, with flesh too coarse for heifer calves, and unnaturally fed."

Of the Herefords, a Judge writes: "I consider that as a whole they showed well, and the cows and yearling heifers were the best I have ever seen at a Royal Show;" and another: "I consider them superior to those at Leeds in quality as well as in number, especially in the classes for 2-year-old bulls, bull calves, cows, yearling heifers, and heifer calves." This important class showed in stronger force than at any previous meeting of the Society, which gives, we trust, a good earnest for the next year. The largely-increased area over which they now extend was mentioned in the Leeds Report, and this year we can congratulate the breeders on a still further extension, and the marked success which has attended the efforts of distant exhibitors to compete with the great local herds. Thus the gold medal for the best bull in the classes went into Shropshire, and that for the best female into Dorsetshire; the first prizes for aged bulls and yearling heifers to the Prince Consort's Flemish Farm in Berks; that for 2-year-old heifers into Gloucestershire; and for heifer calves to Warwickshire; two prizes only being left for the county from which the breed takes its name. With only two exceptions, all the animals presented that uniform appearance in colour and marks which popularly characterises the pure-bred Hereford. The spots on the face and legs of "Maximus," the winner in the Aged Bull class, as well as his general appearance, tell that he is closely allied in blood to the Tomkins's mottle-faced Hereford; and he seems from the herd-book to have a dash of Tully Grey, as well as red with white face—an amalgamation to be found, as in former years, in nearly all the animals

shown, and particularly in the winners of prizes. It is also worthy of remark that 8 winners out of the 24 were either bred by or directly descended from the herd of the late Lord Berwick, who crossed his "Knight Greys" with red and white-faced bulls from the herds of Messrs. Hewer, Longmore, Carpenter, Williams, &c. The gold-medal bull, Mr. Hill's "Milton," and a third prize bull Mr. Duckham's "Victor" (who gave 11 months in his class), were both by sons of his lordship's "Cherry 7th" by "Hotspur." Mr. Read's first prize 2-year-old heifer "Theora," and his second prize heifer calf "Miss Southam," were both daughters of the same cow; "Ada," "Adela," and "Adelina," winners of a third and two first prizes, were of his lordship's Silver tribe; and Mr. Naylor's second-prize "Heiress" was also bred by his lordship, but from a different tribe. The Cow class, which was headed by Mr. Coates's gold-medal winner "Matchless" was universally commended, as were those for 2-year-old bulls, yearling heifers, and heifer calves. Mr. Hill's "Milton," and "Adela," from the Prince Consort's Flemish Farm, were both first prize winners at Leeds last year (although the latter was disqualified from a misdescription); and "Adela's" half-sister, Mr. Baldwin's "Adelina," from "Agnes," now takes the first heifer calf prize.

The Devons "were the best I have ever seen, and I have attended eleven Royal meetings; the cows, heifers, and yearling heifers especially were very superior." Mr. James Davy, of Flitton, sent 5 animals, and won four firsts and a second (against one of his own), besides taking both gold medals with "Duke of Flitton" and "Temptress," neither of which had been in a show-yard before. The Messrs. Quartly were not exhibitors; but the "Duke of Flitton" and Mr. Newbery's "Bonaparte," which was second to him in his class, were by Mr. James Quartly's "Napoleon;" and Messrs. Palmer's "Lord Cary," the third in the same class—Mr. Bodley's "Champion," the second in the 2-year-old Bull class—and "Crown Prince," from the Prince Consort's Norfolk Farm, the first in the Yearling class—were of pure Quartly blood. Mr. Farthing's "Viscount," who took the first prize in the Yearling class at Leeds, was first in his class again; and "Crown Prince" was alike promoted from the head of the bull calves to that of the yearlings, his place of last year being taken by "Prince Alfred," of the Prince Consort's blood on both sides, making the fourth first-prize taken this year by animals from the Prince Consort's Norfolk and Flemish Farms. Of the 11 in the Cow class, one of which did not come, no less than 5 were commended and 1 highly commended; and Mr. G. Turner's "Piccolomini" earned second honours, as at Leeds last year. The winner "Temptress" (whose Pink blood has been in

the Davy family for upwards of a century) was drawn out for the gold medal with the same owner's first prize yearling heifer "Princess Alice," who was the first heifer calf at Leeds; and all the heifer and heifer-calf classes were commended.

One of the Judges speaks of Mr. Davy's

"Duke of Flitton" as being a capital type of the North Devon, with a rare, level back, an astonishing loin, a good fore-quarter, the best of texture, and with all his points in good keeping, but with not so pleasant a head. Mr. Newbery's 'Bonaparte' was useful, but not so level and symmetrical; and Messrs. T. and J. Palmer's 'Lord Cary' was nice and level and of good texture, but of diminutive size. Mr. Farthing's 'Viscount' is a very meaty animal, of immense size for his age, but of a very different style and touch to the pure North Devon, and far too much loaded with fat for breeding purposes; 'Crown Prince' was useful, but deficient in mellowness and depth of flesh. 'Temptress' was a splendid specimen of a North Devon, with a lovely head, and gracefully-laid shoulders and chest, forming one of the finest fronts ever seen; she was, perhaps, the most perfect type of an animal in the yard. 'Piccolomini' was also a surpassingly good cow; and the third cow, Mr. J. A. Smith's 'Rachel,' a very neatly-formed animal of exceedingly good quality. Mr. Paull's two-year-old first prize heifer, 'Young Hebe' (bred by Lord Portman), was all that could be desired, with a fine touch and nice even frame of large size. Two such yearlings as Mr. Davy's 'Princess Alice' and 'Young Empress' have been seldom seen in one man's possession, but I am inclined to think that the latter will make the better of the two, as she is younger, and promises to have more size and commanding appearance, with quite as good quality. His first-prize heifer calf, 'Lady Fortune,' was also remarkably neat. Mr. James Merson, a very steady supporter of these classes, showed some beautiful animals, and took four prizes."

The Sussex Cattle were, "as a whole, good, and I should say decidedly improved. There were two very useful old bulls and two or three very good cows; but the younger animals were hardly equal to the elder ones. They had fine, deep flesh, and quite maintained the improvement which they have shown of late years at Smithfield." Experience has proved them to be as hardy if not hardier on poor cold clays than any other breed. The classes were very fairly filled, and three out of the five firsts were awarded to the Messrs. Heasman, who found themselves alone with a cow and a bull in these classes last year.

Only fourteen *Long-horns* were entered in the six classes, and of these "the breeding cows were good but the bulls had nothing to recommend them." The first prize in the cow class was won by Mr. Warner's "Lupin," Lieutenant-Colonel Inge being second with his "Fill-pail," and first with his aged bull "Tom." Mr. Burbery, whose blood dates back as far as the beginning of the Wroxton herd in 1756, had the first and second prizes for yearling heifers, and also bred Mr. Davis's first prize yearling bull. Although they are generally looked upon as relics of a bygone age, there are several herds of this breed in the Midland Counties and elsewhere, varying from fifteen cows and upwards. Their "fill-pail" talent (which is well indicated by the conven-

tional milking-marks) admits of no doubt; and although the young stock are put on the poorest pastures and get sadly spoiled thereby, they retain the faculty of fattening at a great age.

The "blood-red dairies" of *Norfolk and Suffolk* mustered nearly as strong as those of Sussex, and "presented several specimens of great merit, size, and symmetry, with good flesh and constitution and plenty of lean to the fat,—all qualifications for making as much good beef at the least possible cost from a given quantity of food as any breed in the yard." Another Judge says, "They were of great merit, and I observed in them great advances in the three very desirable acquirements of size, symmetry, and quality; and in improving the two latter the former has not, as is too often the case, been sacrificed but rather increased. In both these classes I observed improvement in the young over the elder branches of their respective families, and these breeds have been under my inspection before." Careful crossing seems to have done much towards correcting their great tendency to be high on the tail. There is evidence of the existence of the breed in the Eastern Counties for upwards of a century and a half. It is thought that they derive their origin from the Poll Angus or Galloway (large quantities of which are still sent to graze in Norfolk and Suffolk) crossed with a red native breed. They are not styled "useful" unless they give their twenty quarts a day when in full milk; and although feeding is not their *forte*, bullocks, if well done to, will weigh their 70 stone of 14 lbs. at three years old. From the favourable impression they created, it is hoped that perhaps in future they, as well as the Sussex, may have classes of their own. Lord Sondes and Sir Edward Kerrison each won first prizes, and Mr. Samuel Wolton another.

Of the five classes assigned to *North Wales* four did not fill, and the two cows which came "had but little to recommend them." *South Wales*, or rather Mr. Clare Sewell Read of Norfolk on its behalf, had a pair of cows among the nine in the classes, which "were, in length, size, and flesh, the best I ever saw." *The Kerry entries* were very short, and the judges considered them "indifferent." Black is the orthodox colour, but some of the experienced breeders consider the deep red to be the best milkers. They fatten well in a short time when they have had some nine months to recover themselves after coming from the mountains of Kerry; and their weight when fat may be estimated at from 3½ to 5½ cwt. Their cost when just taken off the mountain varies from 2*l.* 10*s.* to 5*l.*, and with good management few herds return a better profit from the pail.

Of the *Cattle from the Channel Islands*, Colonel le Couteur thus writes: "Although they did not come in very great numbers, some very beautiful animals were shown. I was pleased to see

that stock bred in England could be continued pure, though in some cases a cross with the shorthorn was perceivable. Such should not fairly come into competition with the pure breeds of the two islands, and a certificate of purity should be demanded if the Judges deem it right." Of the fourteen prizes nine went to the Channel Islands, the Jersey men being beaten twice for first place and the Guernsey once. About 1200 head are annually imported, of which two-thirds come from Jersey and not twenty from Alderney, which is now so much built over.

The Guernseys are the larger breed of the two, but the Jerseys are generally more choice. The blue and grey are perhaps the hardiest, but pale fawn and white and smoky fawn and white have always been preferred, as giving the richer quality of milk.

Horses.

Owing in a great measure to the very superior arrangements, by which comfortable wooden boxes (whose front partitions should be made more secure) were substituted for sheds open on two sides, the show of thorough-breds "was decidedly superior to that at Leeds." It was a somewhat remarkable coincidence that horses which were first and second for the Derby in their respective years should have occupied those positions for the 100*l.* and 25*l.* prizes for "improving and perpetuating the breed of the sound and the stout thorough-bred horse for general stud purposes." The three Judges in this class were unanimous as to Mr. Phillips's "Ellington," being decidedly the most useful animal for that purpose among the twelve which were brought before them, and which were ordered out into the horse-ring for comparison by four at a time. "With an especially good back and well-formed limbs, this son of 'Flying Dutchman' and 'Ellerdale' combines very fine action and quality. His head might be a little sweeter, but the slight tendency to be light in his middle, might be accounted for by his having fretted and refused to eat anything during the first part of the show week." "Marionette" had "good hocks, thighs, and depth, but was defective in his fore legs." "Sir John Barleycorn," who was second for this prize at Leeds, "is losing his muscle with age, and is, moreover, rather too long below the knee;" and but for a curb, "King Brian" might have shared his high commendation. Their competitors had generally "good action, but were too light-boned;" and we looked in vain for one of those low, long sires on big and short legs, which are every year becoming more rare. The same remark applies to the thorough or half-bred hunter-sires, which the judges considered to be, as a lot, "decidedly deficient in power and light of bone for their size." The bar-sinister, which is such a disputed point among

breeders of hunters, did not operate against "British Statesman" (who was second in this class to "Canute" last year), and the second, "Billy Barlow," both of them bred in Cumberland, being by "Royal Ravenhill" and "British Yeoman," which won the same head prize in 1855-56. "British Statesman" had only one thorough-bred cross in his pedigree, but makes quite as much show with it as "Billy Barlow" with two. The highly-commended "Horatio" had a good deal of hunter fashion, but Professor Spooner's examination made the choice very limited. Only four hunting brood mares were brought into the ring, and a good-looking chesnut mare, "The Yore," by "Bay Middleton," won her 47th prize as a dam of hunters or thorough-breds, but was subsequently disqualified on account of wrong entry. She would also have been objected to on another ground. Lord Berners' "Barbara" (to which the prize was eventually awarded) occupied the same place in this class as she did at Warwick; but "the chesnut came right away from her and all the lot."

The hunter geldings of 4 or 5 years old presented a miserable contrast to the grand array which Yorkshire and Durham sent up to Leeds; and we looked in vain for "Burgundy," "Holmes's Brown," "Emerald Isle," "Adam Bede," "Neck or Nothing," and "Overplus." Nothing interfered with the claims of the winner—"a long, low, and strong chesnut, by "Marsyas"—with fine action, up to 14 stone, and just what a hunter ought to be for a fast 50 minutes." Mr. Elwes's second prize horse was much plainer, but useful, and with great power. Only one prize was given in Class IV. for hunting mares, and that to Mr. Robinson's "Lady Bird," a remarkably neat and nice mare, but rather light-boned.

The Judges of the carriage horses, roadsters, and ponies, have reported as follows:—

"Class I. *Coaching Sires.*—This class furnished only five competitors: one from Yorkshire, and four from the home district. The Yorkshire representative, Mr. Holmes' 'Young Pottinger,' was a grand goer, and a very level, useful horse, but had hardly length and fashion enough for a first-class coaching stallion. He was, however, an easy winner of the first prize; the second went to Mr. Kitchin's 'Speculation,' a good-looking dark-brown horse, with rather narrow feet, and not exactly calculated to get coach-horses. Nothing else in the class requires notice.

"Class II., *Coaching Mares,* contained three fine animals. Mr. Cooper's mare, by 'Brutandorf,' dam by 'Langar,' a splendid mare, with action, size, colour, and fashion, in short, all that could be wished, was placed first; Mr. Holmes's 'Polly,' also a fine mare, took the second prize; and Mr. Platt's 'Wonderful Lass' (the prize Cleveland at Leeds), was a good third. The other two were nowhere, and No. 746 was misplaced in the catalogue.

"Class I. *Roadster Stallions.*—In this class twelve candidates appeared, the same number as at Leeds, but not equal to them in quality, and not headed by a 'Quicksilver.' Mr. Johnson's 'Merrylegs,' the first here, and second to 'Quicksilver' at Leeds, is a nice level-made horse, of great substance, with

good shoulders and short legs, and more like getting a gentleman's hack than most of these trotters. Mr. Martin's 'Crocus,' the taker of the second prize, is more of a professional trotter; he has grand action and good limbs, and although a little light in his back ribs, is altogether a very useful horse. Mr. Moss's 'Buck Merrylegs,' who has taken many prizes, and is a very useful good sort of horse, was highly commended, an honour he did not attain at Leeds. No. 748, Messrs. Hargreaves and Craven's 'Young Pride of England,' a good-looking roan, was a favourite with the public, but his hocks stopped him with the Judges.

"Class II. *Roadster Mares.*—This small class of four was reduced to three by the disqualification of No. 761, 'Kitty,' aged about 22, from years and infirmity. Mr. Jonathan Peel's nineteen years old mare 'Jessie' was an animal of great power and fine action, and just the sort of mare to breed from. Mr. Percy's second prize mare, 'Crafty,' had less size and power, but was a very good goer. Neither of them possessed quite as much of the roadster character as Mr. Walter Burch's roan mare, No. 709, which took the first prize in this class at Canterbury, and was this year shown as a hunting brood-mare, where she was out of her place.

"The *Pony Stallions*, above 12½ and under 14 hands.—Looking at the great demand for good ponies, this is a class worthy of encouragement. Nine competitors were brought out, several of which were very useful animals. Mr. Blenkiron's 'Napoleon' was a strong, active, and really useful pony, with substance enough to carry a heavy man. Captain Edwardes's 'Taffy' was something of the same style, but his hocks were deficient. Mr. Ashwell's white-legged chesnut was of a different stamp, nearly thorough-bred, a little light in his body, but with capital legs and feet, and a wonderful goer, which gave him the second prize. Mr. Moffatt's 'Tom Sayers' (whose sire, 'Highland Laddie,' won this prize at Chester), was a good useful pony, and likely to get stock with strength and substance. Mr. C. Moffat's 'Stranger' was very pretty and a splendid mover, but too light to win here; and Mr. Massey's 'Sunbeam,' a quick active bay, was commended. Dr. Beevor's 'Bobby,' now 22 years old, and the sire of very many good ponies, was, or rather had been, the best pony in the class, and take him for symmetry, substance, size, quality, and colour, he is almost perfection; but the poor old fellow was lame, and his day is gone by, so he was very reluctantly passed over and highly commended.

"*Mare Ponies*, Class II.—Of the eleven exhibited, Mr. Matthews's 'Ozone,' a very neat active brown, with great liberty of movement, was placed first, and Mr. Branwhite's 'Pretty Girl,' a good-looking roan, with more substance but less action, second. Both were valuable animals and worthy of their position. Dr. Beevor's 'Indiana,' a 4-year-old, by 'Bobby,' was a picture, but rather light of bone: she is very likely to be heard of again. There were some other pretty ponies, but nothing to call for especial notice.

"*Pony Geldings*, Class III., were a very moderate lot. The prize pony, 'Pretty Boy,' came out of the same stable as 'Pretty Girl,' but was not her equal.

"*Ponies not exceeding* 12½ *hands*, Class I. and II.—With the exception of a drove of half-starved Shelties, the 45*l.* offered as prizes for the three classes of small prizes produced only five competitors, viz., one stallion, Mr. Baker's 'Gem,' a nice active Exmoor pony, bred by Mr. Robert Smith, and, as might be expected, good of the sort. Besides the Shelties, there were two mares and a stiff little roan, which took the first prize in Essex a few weeks ago, as he also did here, the other being an active Welsh 3-year-old; but neither of them first-rate specimens. The geldings were only two in number: a grey Exmoor, 'Cornet,' belonging to Lord Braybrooke, which could go, and a golden (Welsh) dun, which could not go; hence the preference was given to the former. This class of animal is too small to be generally useful, and surely the 45*l.* might be more usefully applied."

It might be advisable, if the pony classes were retained, to raise the standard in each to $14\frac{1}{2}$ and 13 hands. Several ponies were sold at high prices: one at 150 guineas, two at 100 guineas each, two at 60 guineas, two at 50 guineas, &c. Such being the case, it would not be wise to discontinue giving prizes.

Another Judge says:—

"It may perhaps be as well in this Report to take in order the classes of horses which came under my observation, and I regret to say that (with the exception of the Suffolks) they did not come up to the high standard of merit which an All-England show and the value of the prizes given warranted; nor do I think that the classes generally equalled those of the previous meeting at Leeds. This is the more to be regretted, as the accommodation provided for them was as good as possible, and owners had not, as on former meetings, to fear the risks and exposure to the weather. The criticisms and judgment of the public, and a twice-a-day exhibition of horses in the ring, added much to the attraction, and also I feel sure, from the constant crowds in the horse-yard, to the pecuniary benefit of the Society. One regulation, however, remains to be altered, since it forms one of the principal reasons which deter many owners, especially farmers, from sending their horses. I allude to the annoyance felt by the exhibitors in having their horses submitted to the searching scrutiny of the veterinary surgeon, and their too often consequent disparagement and rejection. I contend that the Judges, if properly selected, ought to be able to discriminate and determine what is and what is not fit to pass, without previous inspection by a veterinary surgeon. If, however, the Judges are at fault, then let the Society's veterinary surgeon be at hand for them to appeal to. The adoption of this arrangement would, I am sure (from the many complaints of the present one which have reached me), greatly increase the show both of stallions and also of horses exhibited for the saddle or for harness purposes. Owners of stallions and farmers will not send their horses to be crabbed and consequently lowered in value because they cannot pass a strict veterinary inspection, whereas when they are submitted only to those appointed to be their judges, if the prize is withheld from them, it is to be presumed there is a sufficiently valid reason, and the horse in question returns home without losing caste or being proclaimed a screw. Many a horse may be most suitable for the hard tasks imposed on him in the field and on the road, and yet may have hocks disposed to curbs, or fore-legs to splents: still I do not see that such a horse should be summarily and at once rejected.

"If the 100*l.* prize did not succeed in collecting together the cream of the studs in England, as one could wish to see, still the two which gained the first and second prizes were undoubtedly the most fitted for 'perpetuating the breed of the sound and the stout thorough-bred horse.' The prizes for the best hunting stallion failed in attracting either as large or as high a class as might have been hoped for. The horses which gained the first and second prizes both had a stain in their pedigree, yet was the Judges' fiat confirmed by the opinion of most of the spectators. In this I find that they agreed with some opinions which I ventured to express in my review of the horse-classes at the Royal Agricultural Canterbury Show, and which opinion met with no small opposition at the time in the pages of *Bell's Life*. I am still of the same opinion that a good, strong, and bony hunter, with a stain, is more calculated to get weight-carriers and serviceable riding-horses than the generality of those thorough-breds which infest our country districts and propagate an unsound and worthless race. I have held over and over again that the thorough-bred horse with action and substance is far preferable in every point of view to any other; but failing in that, I prefer a style of horse for getting hunters similar to those to

which the prizes were lately awarded. What, after all, are the chief requisites for a hunter? Power, endurance, and action. If we lose sight of these qualities, we cannot expect to breed a marketable article.

"The premiums given for hunting-mares and geldings brought a good many to the show, but, in my judgment, not of the highest class; still as many of them realized high prizes, I hope their owners were compensated for their trouble in exhibiting them.

"The carriage-horses and roadsters are two classes which want all the encouragement the Society can afford them; for, unlike the thorough-bred horse, which is universally patronized in the highest quarters, these greatly depend upon the prizes given by the Royal Agricultural Society and other local meetings. I do not think they were so well represented as I have often seen in the north of England; and I am inclined to recommend that the prizes given to the Pony classes should be taken from them and added to the classes for carriage and roadster stallions and mares. It is all very well to give prizes for ponies when the meetings are held in the Welsh or hill districts. Even then (as they belong more strictly to the vicinity) they should be encouraged by local prizes, as has been done on several occasions. At a meeting like the late one, money was quite wasted when given for ponies under 12½ hands high. So bad was the class of pony geldings in Class III. that the Judges for some time withheld the prizes altogether; and in Classes I., II., for ponies under 12½ hands high, the 35*l.* which was given away was pretty nearly the value of the lot exhibited. A very pretty stallion, bred at Emmett's Grange, got the prize, but the prize even here was more than the value of the pony; and in the class for mares, the little things which were deemed worthy of the prizes were most ordinary. Again, in the class for ponies above 12½ and under 14 hands, no animal was shown at all above the most average standard of merit. The dun pony which gained the first prize was a useful pony, and the chesnut which was second was a nice blood hack rather than a pony. On these considerations, I feel sure that 70*l.* might safely be transferred to the more useful classes of hunters, roadsters, and carriage-horses. I should recommend 30*l.* for the first prize for roadsters, and the same for carriage-horse stallions. One prize of 20*l.* might still be kept for pony stallions above 13 hands, as it would include what are called cobs. The prizes given to carriage-horses fell to the lot of two horses bearing a different stamp. The first prize was gained by a very strong-legged horse by 'Pottinger.' He was of the stamp so desirable to preserve—long, low, and wide. The second prize horse, perhaps, showed more quality, but was hardly as suitable for the purpose.

"In the Hackney class, it was quite a study to see the different style and breeding of the animals exhibited. Two thorough-breds were put into it, which was quite a mistake on the part of the owners.

"The horse called 'a roadster' is too apt to degenerate into a coarse, heavy-necked, harness sort of horse; whereas our chief aim should be to get a short-legged, strong, and at the same time wiry, animal, with a perfect forehand, and plenty of quality about the head and hind-quarters, and not less than 14 hands high. The winner in this class answered to a good many of these requisites, though not entirely. They were all too much of harness-horses; the second especially, though a very useful horse for any district. A roan horse in this class, which did not gain a prize, had much to recommend him. I am very anxious to draw as much attention as possible to this class, being convinced that the time is come when we can scarcely obtain any good specimens of the old-fashioned long and low hackney. I have now run over, though very briefly, the chief points which struck me in the late Agricultural Meeting. I trust that the Society will continue to encourage as much as possible all the horse classes, with the exception of those for ponies. They, as I

have said above, are hardly worth the liberal prizes hitherto given; and if one prize of 20*l.* is given, and the remaining 70*l.* added to other classes, it would be *pro bono publico.*"

The *Suffolk Horses* had this year, for the first time, a class to themselves, and they did full justice to the step thus gained by 62 entries, or 9 more than the rest of the agricultural and dray horses put together. One of the Judges speaks of their being, "as a whole, the best I have ever seen." "The 2-year-old colts and fillies," says another, "were very good classes, but might be improved by having a little more substance in their fore-legs, and rather less tendency to be heavy in their tops. The mares and foals made up an excellent class, containing several very stout, clever, and active mares, and it is rarely that I have met with a class so difficult to decide upon."

It was one of the greatest treats of the horse-ring to see the 13 2-year-old Suffolk fillies and the 26 Suffolk sires, with only one white face amongst them on their parade. Still, if a white blaze was so rare, the orthodox chesnut shade does not seem to be sufficiently defined, and there are at least three shades to compete with the "cherry red" of the county. Mr. Playford's prize horse, "Colonel," was of a rich dark hue, with a most elegantly turned top, but with thighs very light in proportion. Mr. Henry Giles, junior's "Boxer"—the winner in the 2-year-old sire class —was a very fine specimen of early maturity, but with less quality. The breeders are getting rapidly rid of the sour head and low forehand, but a veterinary examination still finds their horses deficient in their hocks and small below the knee; and "if the Suffolk men would only turn their attention more to the feet of their animals, they will be difficult to beat for 'agricultural purposes.'"

The *other Agricultural and Dray Horses* "were not well represented. Many of the stallions had, like the Clydesdales, not finished the season; and of those that came so many were unsound, that we were compelled to pass them over for the prizes in favour of inferior horses. Still the winners in Classes I. and II. were very useful horses."

Sheep.

In the Leicester classes, which contained 66 rams and 7 pens of theaves, the shearling rams "were inferior to what we have seen," which was, perhaps, in a great measure owing to the inability of a leading flockmaster to send five or six of his best shearlings, which had "broken down in training." Throughout the Sheep classes the shearlings had generally the worst of it by the side of the old sheep, for which the fact that this year the Show was fixed earlier than usual by three weeks, at a season

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when every week is of so much importance, may help to account. The first prize shearling of Mr. Sanday was a gay, taking sheep, but perhaps hardly equal in his fleece and flesh to the third from the same flock; while Mr. Pawlett's, which separated them, had a very fat back, but not the same quality of fleece. The Aged Ram and the Theave classes "did not show any improvement or retrogression as compared with Leeds;" and the former class was headed by the gold medal winner, a remarkably good two-shear of Mr. Sanday's, which for "form, quality, mutton, and general appearance was exactly what a true Leicester sheep should be," and was sold for 140 guineas by auction in the following month. It is worthy of note that the second prize taker, a three-shear, earned second honours for the third time at this Show. The first prize theaves, also the property of Mr. Sanday (who won three firsts, two seconds, and two thirds in these classes) were "remarkably uniform in their character," albeit one of them was half-faced.

The Lincolns, considering the anticipations formed of them as the staple breed of a great county, and the renovators, in respect of size and wool, of other breeds in the midlands, were weak alike in numbers and stamp; owing, it may be, to the disinclination of the most successful letters to run the risk of exhibiting. Hence the Judges report that there was "positively not one good one among them." Mr. Marshall's first prize ram was, perhaps, an exception; and Mr. Greetham sent rather a nice pen of theaves, which had no opposition to face.

"*The other Long-Wools*" presented, as was to be expected, rather an anomalous medley, now that the Lincolns, Cotswolds, and Romney Marsh had classes of their own, and there were scarcely two lots alike. The Judges ran on "Leicester and Lincoln" in the Ram classes, and passed over Mr. Aylmer's with commendations, till they came to his pen of theaves, when they were obliged to accept the type. These "West Derehams" were a remarkable feature of this class, and consist of successive crosses of Cotswold on a Leicester and Lincoln foundation. They would appear to have more lean meat than the Leicesters, and to clip well, and have been remarkably successful both as competitors at Smithfield and as crosses for Southdowns and black-faced sheep.

The Cotswold men brought up a very fine lot of 60 shearlings, "as good as they were numerous. Messrs. Garne's and Mundy's, the first and second, were great in shape, flesh, and wool, and the third and reserve number were very near them." In Class II., which contained 23, Mr. Lane's first prize ram is described by two Judges as "the best they ever saw," and the others "worthy of every commendation;" but still, although the first

prize ram was seldom exceeded in size, his fleece was perhaps rather of the "trimmer" order, and his colour and contour of face savoured slightly of the Leicester. This style was somewhat observable in nearly all the winners, and the second prize shearling was also a little feminine in the head. A grey face had, however, slipped up second in the Aged Ram classes, but such honours were rare. Throughout the 83 the grey face was principally found in connection with the close trimmer coat; and it would seem that a combination of these two qualities is more studied by ram-breeders for the purpose of suiting hirers than the real lustre-wool. "The first pen of prize theaves was remarkably uniform and good, and very much in advance of the rest; and on the whole it may be said that the old sheep were never larger or better as a lot, the shearlings an average, and the theaves not an average." Still the Judges were not lavish in their approval, and only gave one high commendation and one commendation in each class. It has been suggested to us that it would be desirable in future to have Cotswold sheep judged by Cotswold men; but on this occasion none of their names were sent in.

The Romney Marsh Sheep breed numbered 20, from four different flocks, of which Mr. Frederick Murton's and Mr. Thomas Blake's were most successful. They inhabit several thousand acres of exposed country, where nothing but a very hardy sheep could live, and are generally kept badly during their first winter, as the Marsh breeders are dependent on the small farmers in the Wealds of Kent and Sussex, from which the flocks return to the Marsh the first week in April. The lambs are shorn, and produce from $1\frac{1}{2}$ to 2 lbs. of wool, which is sold at two-thirds the price of the regular fleece, which generally goes to the French market. The Kentish graziers are very particular about using a stain of any other blood. On the uplands, and amongst the arable farmers, a higher-bred sheep is used, selected from the Romney Marsh, and crossed with Improved Kents or "Goord's sheep;" but, although they mature earlier, they do not suit open marsh feeding. Mr. Goord, who died about twenty years ago, always denied having any crosses out of the county; and those crossed with his blood took their part well in the Battersea competition.

For the 90*l.* given for *Pure Native Irish Long-Wools* there was no entry.

"Speaking from what I remember as a spectator at Leeds, I should say that, as a whole, the *Downs* were much the same this year as last." Another Judge thus writes of them: "The *Southdown* shearling rams were not so good as I have seen at many of the previous meetings; and I do think the older rams

were not quite so choice as usual. There were several good pens of shearling ewes, and the one which took the first prize was excellent."

Although the Southdown classes visibly lacked the old Babraham element, which lent such force to the Canterbury and preceding Shows, the breed was numerously represented by 51 shearlings, 25 old rams (which had the best of their juniors), and 18 pens of theaves. The gold medal fell to Mr. Rigden's old ram, in preference to Lord Radnor's shearling. Sir Robert Throckmorton's pen of theaves, although inferior to Lord Walsingham's in size, were neatness itself, and, as a Leicester breeder well termed them, "enamelled beauties." One of the Judges says:—

"The shearlings were not a good class, owing to an introduction of fresh blood amongst the Downs, and many of the sheep showed symptoms of coarseness and had lost much of the beautiful wool and caste of the Sussex Down. Beyond the prize sheep the class was moderate. The rams as a class were good. Mr. Rigden's first prize sheep showed every point of a good Sussex Down, and was, in fact, one of the best sheep I have seen for years; the second and third prize sheep (both Lord Walsingham's) were good. The theaves were not at all good beyond the prize pens and those commended."

The Shropshires.—"The useful and rent-paying race of 'Shrops' (which is much sought after in Ireland), was for the third time shown in a distinct class, and quite kept up the character for symmetry, early maturity, great weight, lean mutton, and wool which it had gained at Leeds and Canterbury."

"Class I.—There were 60 shearling rams exhibited in this class, but they varied exceedingly both in character and quality, which made our task a difficult one. We took size and early maturity as the first consideration; and, taking these sheep on the whole, we do not think them up to the average of former years, and there was certainly not a perfect animal in the class. Mr. T. Horton's shearling, which obtained the first prize, was a good sheep, with a fine dark countenance, standing wide and well on short legs; but his loin was badly formed and not well covered with flesh. The second prize sheep (Mr. Thomas Mansell's) was a level-grown animal, with good wool and flesh; but his neck was small, and his head not masculine enough for a large breed of sheep. The third prize fell to a smart-looking sheep of Mr. Henry Matthews's, with good coat and nice quality of flesh; but he was not long enough in his quarters, and his tail was badly set on.

"Class II.—There were only 24 competitors in this class, but their high character quite compensated for the short number shown. The three prize sheep were wonderfully fine animals, and there was hardly a sheep in the class (which was generally recommended) that was not worthy of high commendation."

Of the first in this class (Mr. Horley's), another Judge writes: "He was, I think, the best sheep I ever saw;" and another, that he was a splendid old sheep, but "wanting a little in his leg of mutton." Of the second, Mr. P. W. Bowen's, it is added, "he had a head in shape more like the West Country

Down than the Shropshire, which militated against him." Of the third (Mr. Horton's), that "with all his other fine qualities, he was too light in the leg;" and of the highly commended one (Lord Wenlock's) that "he stands too near behind." "Only 9 pens of theaves competed in Class III.; but, take them as a whole, they were better than those exhibited at Leeds last year; the competition between the three prize pens was very close, and had our fiat been reversed, I believe there would have been little fault found."

"*The Hampshire Down Sheep* presented in their various classes the usual difference of type between the original West Country Down sheep, with its large form and strong constitution, and the 'Improved Hampshire Down,' with its more symmetrical form, better flesh, and finer wool. In each type their tendency to early maturity, which has given this breed of sheep their high character, has been properly preserved; and this is evidently a great point with the breeders.

"In the shearling rams great size, and, in most instances, excellent quality of flesh and wool are found; but the acceptance of a black face as a type of the breed has led, in many instances, to a tendency to rustiness, if not to blackness, of the wool round the ears and poll; we regard this as a grave defect, which, in common with occasional thickness in the neck and scrag, exhibits itself in some cases throughout all the classes.

"The above remarks are equally applicable to Class II., though there the competition was much less.

"The competition in the shearling ewes was considerable, and in this class especially the various characters of the Hampshire Down sheep were well represented, and the difficulties of the Judges proportionably enhanced.

"The theaves which took the first prize were wonderfully good, with the exception of their necks, which were too thin; a tendency to blackness was also observable round some of their polls. On the whole, we may remark that the animals of this breed showed no improvement on those exhibited at the Leeds Show; indeed, we think that the class did not come up to the standard of 1861, if we except the shearling theaves. Berkshire contributed six out of the nine winners, and Hants and Wilts the remainder."

The *Oxfordshire Down* class made up 62 entries, of which no less than 40 were shearling rams; and but for overfeeding—which had sadly crippled the resources of two successful exhibitors of former years—the array would have been much larger. Still the Judges report that "each class contained some very good sheep, and they must altogether be considered as quite up to the mark. The theaves, especially, had not by any means that uniformity which they ought to possess, and the same men were obliged to resort to sheep of different types to make up their pens." Another Judge observes: "I consider them a very useful class of sheep; but the quality of their mutton is rather too loose to please me." Many of them in their faces showed a strong affinity to the Cotswold sheep, and among the prize theaves many of the heads bordered on the Leicester. The Judges' attention cannot be too strongly directed to the habit of "cutting down." Immediately after Christmas they are housed, and half the wool is cut

off; and the perpetual trimming into shape which goes on enables the animal to fill the eye, to the great disadvantage of those which have been fairly shorn. Mr. Charles Gillett, of Cote House, Bampton, had all the first prizes, as well as a second and third.

The three classes of *Dorset Sheep* only commanded 13 entries, and these came from only three exhibitors. Mr. Danger's entries won the two head-prizes in each class; in fact, only two sheep, the property of Messrs. Bond and Paull, returned without a prize or a commendation. This very old breed is kept in large flocks on the high lands of Dorset and Somerset, and derives its peculiar value from its early production of lambs, and its aptitude to have twins with the fewest casualties. With "the Sale ewes" the Southdown ram is used, and early in October they are sold at Weyhill Fair to graziers in the Isle of Wight, Hampshire, and Sussex, who provide the earliest lamb supplies to the metropolis. In other respects it is behind many other breeds, and lacks fattening properties. This may arise in a measure from the fact that few breeders are graziers, and that the wether-lambs are sold in store condition in the autumn of each year—a remark which applies peculiarly to Dorsetshire, where the greatest number are kept. In Somersetshire they go by the name of Somersetshire or Improved Dorsets, and there (seeing that the breeders graze as well) their fattening properties are better developed. The two-tooth wethers in Somersetshire become fat in May, when they are 15 months old, and kill well as regards quality of mutton. "The competition in these classes was very limited, but the animals exhibited were of very superior quality, and represented admirably the character and excellence of the breed."

The *Mountain Classes* presented sheep of every variety—"Exmoor Mountain, or Lonk," Cheviot, "Limestone Mountain, or Farleton Knott," and "Scotch Mountain;" and if the pure Lonk won all the first and two of the second prizes for the Forest of Bowland, the Cheviots stood second as shearling ewes, and the Exmoors monopolised all the third prizes.

The class earned the report of "not numerous, but very good indeed; in size, mutton, and wool the Lonks were the best we ever saw, and a pen of Cheviot shearlings (which proved to be Colonel Pennant's) were exceedingly good. The Exmoor sheep, though rather small in size, handled well, and turned up very beautiful firm mutton." Few sheep have been more improved than the Exmoors during the last thirty years: their weight at the beginning of that period could not have been more than 56 lbs., whereas Mr. Quartly's pure-bred wethers at Smithfield last year weighed just three times that amount. All

the five Lonk winners (two of which belonged to Mr. Eastwood and three to Mr. Jonathan Peel) are of a breed which has inhabited the Yorkshire and the Lancashire hills time out of mind. Mr. Peel brought out "Mountain King," who has won nearly fifty prizes in six years, for the last time, and with "Mountain King's Son" as his second finished his unchequered career. His fleece was found afterwards to weigh 17 lbs. It is a Yorkshire boast that where "Lonks thrive, Cheviots would die;" and some of the breed are about to be crossed with the native hill-breeds in the Pyrenees, and with the black-faces of Scotland.

Pigs.

The *Pig Classes* were as usual very large, comprising no less than 70 boars, 98 sows, and 26 pens of sow-pigs above 4 and under 8 months. The Berkshires had for the first time two distinct classes, which filled well. The head prizes in both of them were won by the entries of the late Sir Robert Throckmorton, who had been alike fortunate at the Warwick Show in the mixed class for sows of a large breed. Lord Wenlock held the same place that he did last year, as first and second with sows of a small white breed; and, as then, a pen from the Prince Consort's Shawe Farm, at Windsor, was highly commended. Mr. George Sexton well sustained the fame of his "Improved Suffolks" by three firsts and a second in the small black-breed classes; and five firsts and two seconds were the reward of Mr. Wainman, with the large, middle, and small white breeds. This gentleman's old "Golden Dream" appeared unsuccessfully in Class VI., though still pretty blooming after rearing 153 pigs at 13 farrows; and it may be mentioned that "Silver Wing," which won in the class of sows of the small white breed, is the daughter of "Silver Hair," the first prize winner in the same class at Leeds last year. Mr. Wainman's "Missing Link" exactly carried out the spirit of her name by taking off the first prize for sows of the middle breed, and blended the size of the large with the shape of the small. As a thrifty, weight-making pig this breed cannot be excelled, and among the Yorkshire cottagers it is especially popular.

One of the Judges has given us his opinion on the classes as follows:—

"Class I. Boars of a *large breed*.—In this class there were some good boars of the sort, but possessing no extraordinary merit, with the exception of their size.

"Class II. Boars of the *small white breed*.—In this class we found some extraordinarily good boars, surpassing, as I think, anything shown at Leeds or elsewhere. We had great difficulty in awarding the prizes, and my brother Judges and myself came to the conclusion that this was an unusually good class;

consequently it was generally highly commended. To Mr. George Mangles was assigned the second place and the reserved number, with his 'Prizetaker' and 'Lottery,' of the Yorkshire and Cumberland breed. The first prize went to Mr. Gavin's 'Roger Bacon,' a cross between Lord Wenlock's 'Cato' and the Prince Consort's 'Windsor Lass.'

"Class III. Boars of the *small black breed.*—Here the first and second prize pigs (Messrs. Sexton's and Crisp's) were very good, as also the highly-commended ones belonging to the same gentlemen. It was a very good class, but not so good on the whole as Class II.

"Class IV. Boars of the *Berkshire Breed.*—In this class I cannot say much of a flattering nature, as I think I never saw the Berkshires show to so little advantage at any of the Society's meetings,—take Warwick, for instance, as a contrast, where they were first-rate.

"Class V. *Boars not eligible for the preceding Classes.*—In this class some very good and useful animals were shown, combining quality and quantity with aptitude to fatten,—a most valuable sort to encourage.

"In Class VI., for sows of the large breed, as with the boars of this kind, nothing struck us as extraordinary but their size. In Class VII., for sows of the small white breed, we came to an extraordinarily good class of animals, among which we had great difficulty in choosing the best. The first prize (Mr. Wainman's 'Silver Wing') was a beautiful specimen of what a pig should be ; the second (Mr. Stearn's 'Victoria') and several others came close in her wake, and it was agreed by all three of us that we never saw so good a class generally. Class VIII., for sows of the small black breed, was good, but not quite equal to the last, although the first and second prize pens (Mr. Sexton's) were a credit to their owner, and the class was generally commended. Of Class IX., sows of the Berkshire breed, we can only remark that they were better than the boars, but did not show the improvement which they might have done with stricter attention to breeding. Class X., sows of the middle breed, quite kept up the reputation of their sort, as a most useful one to encourage. In Class XI., for young sows of a large breed, there were only three pens, but these were good specimens of their kind. We now come to the quality-lot, Class XII., pens of young sows of a small white breed, the first and second of which (Lord Wenlock's) would be hard to beat at any show. They were magnificent, and as good as those exhibited by his lordship at Leeds, which then struck me as being perfection. Class XIII., pen of small black sows, quite equalled the boars of their kind. In Class XIV. the pens of young Berkshire sows showed some signs of improvement, but with the exception of the first pen (Rev. H. G. Baily's) there was little merit ; and in Class XV., pen of young sows of the middle breed, we found some very useful animals, carrying out the description given in Classes V. and X., especially the first prize pen (Mr. Wainman's)."

Another Judge adds the following remarks :—

"So excellent were some of the classes that the Judges were occupied for nearly seven hours in making their awards, and nearly two hours were bestowed on one class alone. Nothing could speak more strongly for the great merit of the animals exhibited. Visitors to the Show who run their eye over the pens, and see most of these obese creatures lying down, cannot possibly arrive at a just estimate of their several merits. Pigs (of all animals required for breeding purposes) should not only be seen standing, but walking, and how often is the effort to accomplish the latter feat abortive ? Hence the formation of feet and legs to carry such a weight of fat and progeny must not be overlooked, and such defects cannot be perceived in a good bed of straw. I think the breeding too closely in and in should be particularly guarded against. Weak ancles, loss of tails, and want of hair (which was rather apparent in some of the

animals before us), are sure tokens of it, and thrift, size, and robustness are sacrificed to an over-desire for quality. The Berkshires, though not numerous, presented a good appearance, and some admirable specimens were shown, possessing size and constitution eminently qualifying them as a "good sort" for farmers, easily kept, excellent foragers, and showing meat close and dense in grain, without much offal. The Suffolk pigs were very meritorious, but did not possess powers of locomotion to the same degree as the Berkshires. In examining the classes I could not fail to be struck with the great difference in size of the pigs of the 'small breed.' Would it not be well that they should be more particularly defined? as some of those exhibited in that class were quite as large as some of those shown among the large breeds."

To this latter remark we may add that the line of demarcation is so undefined that pigs exhibited in the Society's pens as of the "small breed" one year, have appeared among the "middle breed" in the following.

We have thus endeavoured to sketch out the leading features of this great International Meeting, and we cannot conclude without mentioning how much our labours would be simplified if the different sets of Judges would meet, either as soon as the adjudication is over or before they leave the town, and decide upon a brief report of the classes they have inspected.

XXVIII.—*The Stewards' Report on the Implements Exhibited at the Battersea Meeting, and on the Steam Trials at Farningham.*

The year 1862 being truly a year of Exhibitions, the industry and productive powers of the Implement Makers have been severely tried. The public, after seeing the Implements in the "Eastern Annexe" of the International Exhibition, might well have imagined that there would be a falling off in the number and character of those to be exhibited in the Show-yard at Battersea, as compared with the display at former Meetings. But a survey of the Show-yard soon dispelled any such idea, and a glance at the Catalogue showed a list of 273 exhibitors; of 5094 entries; and a money value on priced entries of 84,528*l.*; to which, if the value of the unpriced articles in the Miscellaneous Department be added, the total value of the goods exhibited may be fairly set at about 100,000*l.* One exhibitor alone brought machines and implements worth 4910*l.*

The effect of improved machinery and tools in the exhibitors' workshops was very visible in the workmanship displayed on the stands. Never was the standard of excellence so high, or perfection so nearly approached, with but few exceptions, in the workmanship and materials.

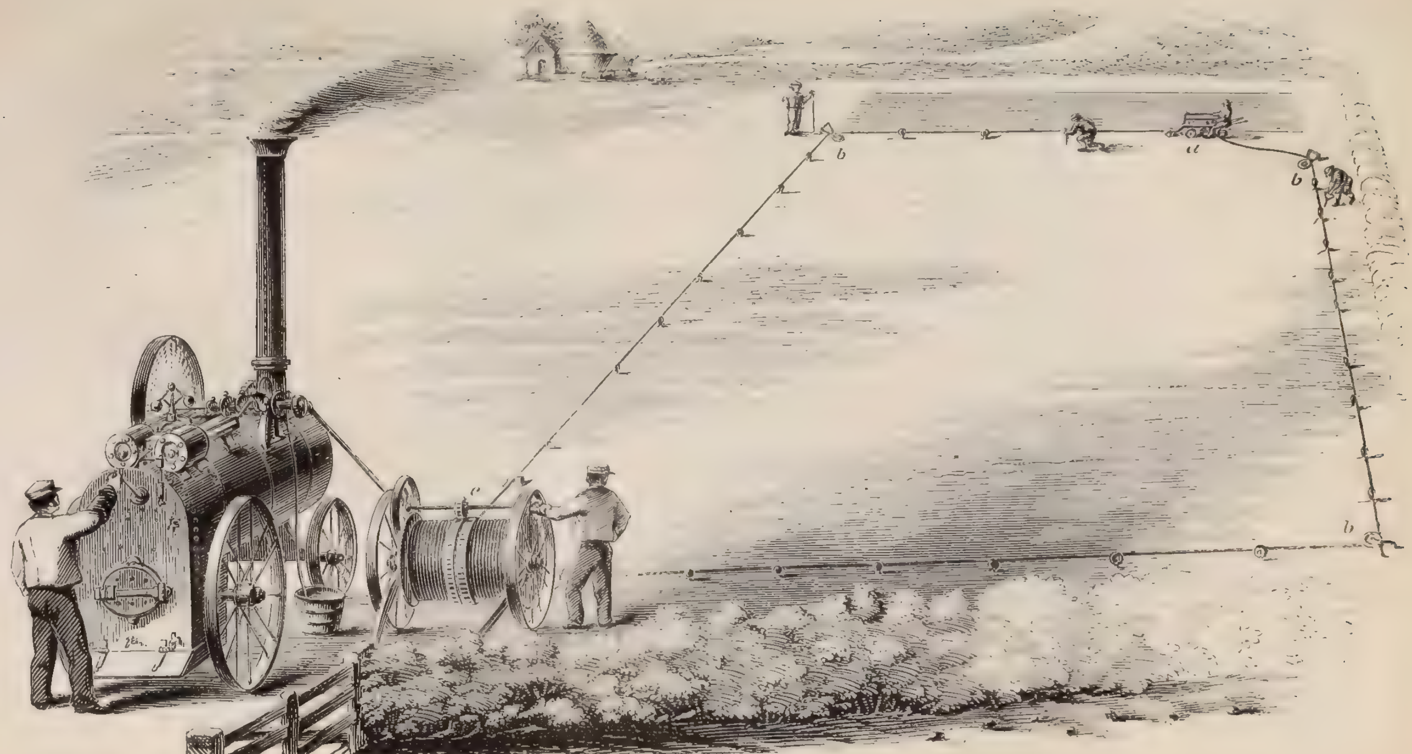
It would appear invidious to particularise the well-known productions of many of the exhibitors; suffice it to say, that those who have taken prizes at former Meetings appeared on this occasion fully to maintain their reputation and position.

The machinery in motion greatly attracted the attention of visitors. Many machines were novel and interesting, and will undoubtedly be found useful in practice. Among those which, for their originality, deserve particular notice, we may mention the following:—

Bradford's Washing and Drying Machine for Steam Power. Art. 2357.
Chandler's Breadmaking Machine. Art. 48.
Child's American Potato Digger. Art. 2112.
Child's Grain Separator. Art. 5037.
Eaton's Corn Dressing and Sacking Machine. Art. 283.
Gardner's Patent Drop Platform for Reaping Machines. Art. 2115.
Garrett's Application of Air to the Threshing Machine. Art. 20.
Grant's Portable Railway for Farms. Art. 2118.
Grant's Trucks for Farms. Art. 2119.
Green's Balance Sowing Machine. Art. 4518.
Hall's Cabinet Mangle. Art. 364.
Hayes' Straw Elevator. Art. 547.
Hancock's Butter-making Machine. Art. 4592.
Howard's Potato Plough. Art. 203.
Loom's Brick and Tile Machine. Art. 5008.
Maynard's Chaff Cutter. Art. 5010.
Nalder's Threshing Machine, fitted with elastic joints for saving oil and friction. Art. 5062.
Ransome, S. E., and Co.'s Lifting Jack. Art. 3764.
Ransomes and Sims' Adaptation of Wright's Straw Elevator and Threshing Machine. Art. 1936.
Ransomes and Sims' (Brinsmead and Lawrence's) Adjustable Corn Screen. Art. 1949.
Ransome, S. E., and Co.'s Automaton Mouse-trap. Art. 3747.
Smith's Enamelled Clay Articles. Stand 163.
Underhill's Corn Elevator. Art. 1246.
Webb's Gates. Art. 3921.
Wright's Straw Elevator. Art. 5048.
Young's Double Drill Drop Sowing Machine, for Mangold, Beet, and Turnip. Art. 367.

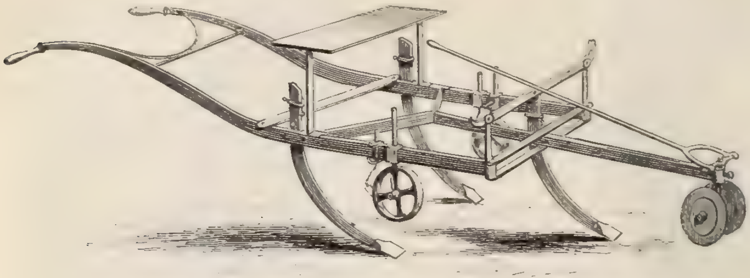
The whole of the above appeared to be ingenious and useful; some were seen in operation, and if this had been the case with all, an opinion might have been formed which would have been of greater public value.

From the difficulty of obtaining the requisite accommodation so near to the metropolis, the Society did not deem it expedient to have general trials of Implements at this Meeting; but, considering the importance of steam cultivation to the public, determined to provide sufficient field-room to enable each exhibitor to show, in his own way, what he could do. Land was provided at Sutton and Horton-Kirby, near the Farningham station on the Chatham and Dover Railway, where, although the soil varied greatly in character, the difference was not of much importance, because the trials were not competitive. Each exhibitor could explain to his friends and the public the circumstances under which he was placed, and the position he occupied was determined by lot, hence there could be no just cause for complaint.



Smith's Steam Cultivator, as at work.

The engraving at p. 397 represents the apparatus of Mr. William Smith of Woolston, as it appeared at work. *a* represents the cultivator, *b b b* the anchors, and *c* the windlass. He also exhibited a second set of implements, called No. 3, of which the following is the engraving.

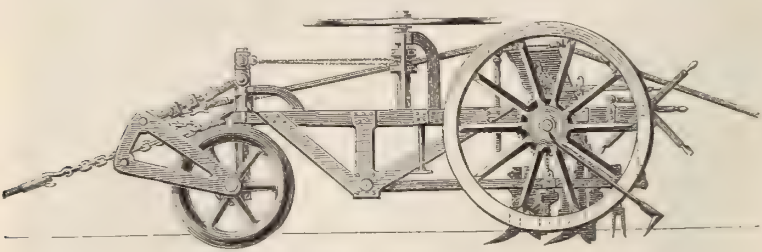


Smith's Patent Steam Cultivator, Marked No. 3 B.

Mr. Smith states that—

"The 6-inch share in the No. 3 implement smashes up all the ground, and each time clears a width of from 10 to 11 inches. The anchors are claw-hooks, which are easily moved to adjust the ropes to irregular hedges, and are especially required when working the combined machine to do headlands with the rest of the field, without shifting the tackle."

He also exhibited a combined machine, as shown beneath, and described by himself.



Smith's Patent Combined Machine.

"The machine consists of a common Suffolk drill, but which, instead of using the ordinary levers, has three three-tined cultivators firmly fixed to a strong bar in the front of the machine; behind each of the tines there are tubes and a seed coulter, behind which the harrow is fixed, to be used when necessary. The machine is guided by a wheel-lever acting upon a pair of wheels in the front of the machine. The turning at land's end is effected by the draught and back ropes passing through a peculiar turning bow, bringing the machine round in its own space. The depth of work is regulated by wheels on each of the three cultivators. This implement effectually cultivates, drills, and harrows land at one operation; and is serviceable to prepare for

barley or oats after turnips fed on the land, for wheat after beans or peas, or for cross-cultivating and drilling beans on land that has been smashed in the autumn. It can be used as a cultivator only, and is the most effective on light land. The power required to work it is about the same as that required to work No. 3."

The steam-engine was made by Butlin, nominally of 10-horse power, fitted up with an apparatus for superheating the steam. The whole of his appliances were of good practical character, with a view to general utility. One of the hardest and roughest of the plots fell to Mr. Smith's lot, notwithstanding which his implements worked in a very satisfactory manner. Mr. Smith certainly is deserving of great credit for his skill and perseverance, in demonstrating the practicability of cultivating the soil, with profit to the agriculturist.

John Fowler, jun., of 28, Cornhill, London, exhibited several articles for steam-cultivation. He showed three sets at work at Farningham.

The principal set consisted of a 14-horse-power self-moving steam-engine, fitted with his patent winding "grip" pulley and anchor. Moved by the action of the traction-rope, it drew occasionally a four-furrow plough with a peculiar kind of breast, which in that form he terms a "digger." Having shown the digger, he then put one of his common four-furrow ploughs in operation. The work done by both these implements was very good, although the land upon which they operated was too light. Had it been heavier, the result shown would have been still more to the advantage of the implements.

The second set consisted of a 10-horse power steam-engine, which gave motion to the winding "grip" pulley, and, by an ingenious mechanical movement, to one of the anchors which moved both the anchor and the engine of the ordinary construction along the headland. This arrangement enables the farmer to work this set with facility with any engine he may have in his possession. The land in this instance was better adapted for showing the work done by the implements, which was good. The implements used were similar to those worked by the former or principal set.

The mechanical arrangements of both the foregoing sets demonstrate the ability and care of the exhibitor, and, had the trials been competitive, he would probably have retained the position he has gained on former occasions.

He also showed a third set at work, consisting of an 8-horse engine, which drove a stationary windlass, moving winding drums placed horizontally. It worked a five-tined cultivator, and appeared to do a great deal of work; but the mechanical arrangement of the windlass was not pleasing. This set did not

work on the second day, owing, it is said, to a disarrangement of the slide-valve of the steam-engine.

Messrs. Howard of Bedford exhibited and worked a cultivator, and a plough of recent invention. They were each worked by a steam-engine of 10-horse nominal power. The engines were stationary when at work, and one of them was fitted with locomotive arrangements, which would enable it to take the cultivator and tackle from field to field.

Messrs. Howard's arrangements with respect to windlasses and anchors are very similar to those of Mr. Wm. Smith; but they have introduced several ingenious mechanical improvements, some of which have been brought out since the Leeds Meeting.

The drums of the windlasses are enlarged in diameter, and the diameter of the wheels is increased, so as to bring the driving-shaft to the proper height for coupling with the steam-engine. The fixed "brakes" are dispensed with, and an ingenious contrivance is introduced, which effectually prevents undue slackness in the unemployed rope, and this without that loss of power which the previous use of the brake entailed.

As an improvement on the rope porters or carriers, a lever has been introduced which enables the boys to shift them with greater ease. Their cultivator is mounted on higher wheels than formerly, and they use a new description of "tine," into which is fixed a thin "cutting-blade," which cuts the soil in a more effectual manner, and, it is asserted, with less power than was formerly required. They have also applied a harrow, which they attach to the side of the cultivator, so as to answer the twofold purpose of bringing weeds to the surface, and harrowing out the wheel-tracks. By an alteration in the curve of the flukes, the anchor is enabled to enter the ground without the tedious operation of digging holes for their insertion.

The plough consists of an iron framing mounted on wheels; and the ploughs are attached to a lever arrangement, enabling one set to be out of use when the other set are at work. The ploughs are fitted with two sets of mould-boards, right and left-handed, so that the field may be commenced at, and worked from either side at pleasure. A locking motion applied to the two land-wheels accomplishes the steerage of the implement.

The land upon which these Implements worked was too light to afford a real test of their capabilities, but they did their work satisfactorily as far as observed.

Mr. John Allin Williams of Baydon exhibited a steam-plough, consisting of an iron frame carried by four wheels; to that frame were attached six ploughs of the ordinary construction, means being provided for lowering the "beams" of the ploughs into the ground by screws fitted for that purpose. Three of the ploughs

were attached to each end of the frame, one set balancing the other; and arrangements were provided to raise either set, and allow the other to work. The writer did not see the Implement at work, but it appeared to be too complex, and it was thought that it would offer too many obstructions for working upon foul land.

Mr. Williams also exhibited a cultivator, which was carried by an iron frame on two wheels. The tines were fixed to levers, and the ends of these levers could be lowered by screws, according to the depth of cultivation desired. It did not appear to be well adapted for entering hard ground, and when first started made but indifferent work.

Messrs. Brown and May of Devizes exhibited a steam-cultivating apparatus, the arrangements of which were very similar to Mr. William Smith's. The pinions were struck out of gear by levers, and the principal difference consisted in having the brakes applied to the pinion-shafts. This arrangement rendered them self-acting, as the working-shaft revolved in that direction, which would lift the brake, and the shaft in connection with the slack-rope would apply the brake in a serviceable manner.

The cultivator resembled Smith's; it appeared to be strong and well made. The implement was not observed in work, and the Exhibitor directed the attention of the Stewards more particularly to the brakes.

Messrs. Tasker and Sons of Andover exhibited a set of Implements for cultivating by steam power, the arrangements of which were generally in accordance with Smith's system, so far as anchors, ropes, and scarifier are concerned; and their peculiar improvement consisted of a newly-invented windlass. The following is the description and detail, given by the Exhibitors, of the advantages they claim for the novelty:—

"1st. The drums (on which the wire ropes are circled) and the driving pulley are mounted on one axle, which axle is also the support of the whole frame when moved from place to place.

"2nd. The drums receive motion from gearing contained within themselves, rendering it impossible for the rope to receive damage by coming in contact with the toothed wheels.

"3rd. The driving-pulley being situated between the winding-drums, the power is given directly from the engine to the centre of the windlass, which remains perfectly still when at work.

"4th. The windlass is capable of being stopped and started when the engine is running at full speed. The management of the implement propelled rests with the windlass man only, which is a great safeguard against accidents.

"5th. Friction brakes being the means of starting and stopping the drums (by fixing the wheel having internal gear), and these brakes being adjustable to any amount of adhesive power required, it follows that if the implement come in contact with hidden rocky substances, or roots of trees offering greater

resistance to the implement propelled than the power of adhesion in the brakes, but less than the power of the engine, the brakes would slip, the implement stop, the engine keep running, and all breakages and stopping of cogs would be prevented.

"6th. As the engine is continually running, it is obvious that single-cylinder engines may be used with advantage with this windlass; whereas their use with other machinery is attended with considerable loss of time, and risk, as the engine would require to be stopped to reverse the action of the drums each time the implement arrived at the headland.

"7th. The same brake that causes the rotation of the drums when fixed, exerts when liberated sufficient power to check the delivery of the slake rope, so as to keep it off the ground, and, being adjustable, any amount of pressure can be obtained, as the resistance of the soil and other circumstances may dictate."

The apparatus appeared to work very well in the field, but the plot of ground occupied by the exhibitor was certainly the most difficult of all to work.

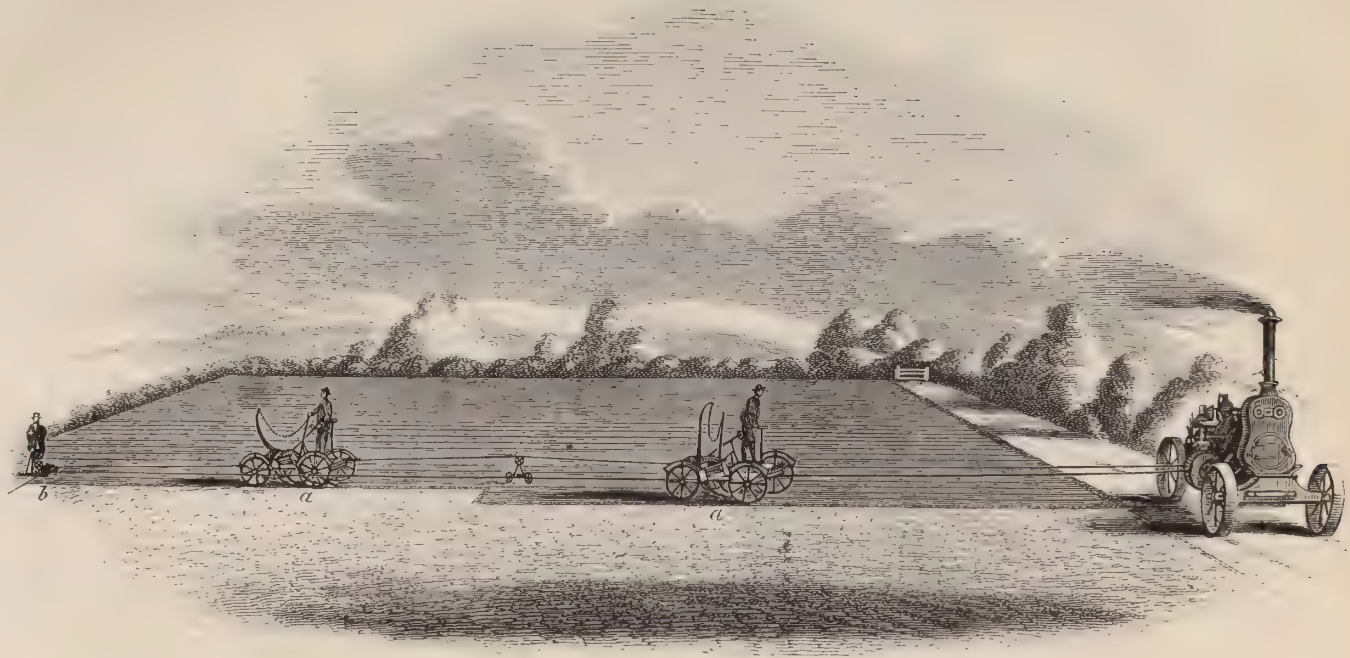
Messrs. Coleman and Sons, of Chelmsford, exhibited a set of steam-cultivating apparatus, invented by Yarrow and Hilditch, of London, which is fairly represented in the following engraving (p. 403).

a a are the two cultivators, as made by Coleman; *b*, the anchor. The system consists in having a steam-engine moving on one of the headlands, fitted with winding reversible gearing; at the other headland is the anchor, with a pulley, round which the rope works. We will suppose the apparatus to be at rest, with both cultivators in the middle of the field. Upon starting the engine, one of the cultivators will commence working, and travel towards the engine, while the other will travel towards the anchor, doing no work. When one cultivator has reached the engine, and the other has reached the anchor, if the motion be reversed, that cultivator now at the anchor moves, working, towards the middle of the field; while the other moves, doing no work, from the engine towards the middle of the field, and so on alternately.

It will be seen that the anchorage has no great strain upon it, as it has only to resist the force required to draw the implement doing no work; and half the rope employed is only subjected to that light strain.

Objections may be raised to the necessity of having two cultivators, but these are not in themselves expensive implements, and the saving in wear and tear of ropes may be a good answer to the objection. It requires no more men to work this system than that of others. It worked very well, and is certainly worthy of consideration where cultivating or scarifying is preferred. For ploughing it is not clear that it would be found admissible.

Although not entered for exhibition, the stewards granted permission



Coleman's Steam Cultivator, as at work.

permission to Mr. J. S. Evenden, of Meopham, to put his system of steam-cultivation to work.

This apparatus consisted of an 8-horse power steam-engine, which drew two Kentish turnwrest ploughs at the rate of 280 feet per minute; the work was well done, but the number of hands employed—8 men and 1 boy—and the time occupied in turning at the headlands, rendered it too expensive for practical use.

A careful examination of the improved machinery now brought into use will show that advances have been made sufficient to prove that steam-cultivation is now becoming a great fact. Still more requires to be done. A deficiency of strength in some parts of the machinery employed is apparent, and will undoubtedly attract the attention of the manufacturers. Most of the improvements tend to lessen wear and tear, and to give greater facilities in working; yet it seems that the actual cost of doing a given amount of work is not materially lessened, and the calculation of the cost of working, deduced from the experiments made at Boxted Lodge in 1856, is not now far from the truth, viz., 7*s.* 6½*d.* per acre, for ploughing land to the depth that it could be ploughed by three horses.

It is desirable that the owners of steam ploughs and cultivators should keep a journal into which should be entered the daily practical results, stating the number of hours of working, the quantity of land ploughed or cultivated, the time lost by interruption for repairs, and the nature and cost of those repairs. Such records would be more valuable for the Society's Journal, and as a guide to the practical farmer, than reports of trials and experiments, which must necessarily be too short to obtain all the facts required.

In conclusion, a caution may be given, which may prove "a word in season" to the users of steam cultivators. We find that Mr. A's cultivator is worked by a steam-engine of 10-horse power; Mr. B's by one of 8-horse power. Mr. C, having one of Messrs. ——'s engines, may say to himself, "Why should I not purchase a set of cultivating tackle, and work it by my steam-engine?" For his guidance, it may be stated that few sets require less than the *actual* power of 20 horses, and the additional power is obtained by working steam of great pressure. It thus becomes necessary that Mr. C should inquire particularly as to the strength of his boiler; for unless care and caution be exercised, many mishaps, such as from the bursting of boilers when they become worn, will assuredly take place.

ABSTRACT REPORT OF AGRICULTURAL DISCUSSIONS.

Meeting of Weekly Council, Feb. 12th, 1862. Sir E. Kerrison, Bart., M.P., in the Chair.

At this meeting a letter was read from Mr. W. Pryor, President of the Nova Scotia Literary and Scientific Society, calling attention to the *Melilotus leucantha major*, or Bokhara clover, as a plant well adapted to the climate of Great Britain. The letter was accompanied by a sample of fibre, roughly prepared, with a view to showing that this plant may not only be of value for paper manufacture, but of some national importance as a cheap material for many varieties of textile fabrics, and may engage more attention just now when a dearth of cotton-wool is feared. The samples of fibre, it was explained, had been exposed to the weather all winter; which exposure, if on the one hand it reduced its strength, on the other proved its durability and fitness for scutching. The manuring or cropping might be done at several times during the season, according to the desired fineness or otherwise of the fibre, as it grows six feet high before seeding. In the sample the remaining wood showed the medium growth of the plant when cropped. This plant grown, mown, and cured like hay, and treated in all respects after the American process of cottonizing flax, now successfully and largely adopted in the Northern States (see the article in 'Hunt's Merchants' Magazine,' for May), might prove of great importance to the manufacturer.

A parcel of seeds of Chinese vegetables, sent by Captain J. H. Lawrence Archer, 60th Rifles, were distributed among some of the members present for trial.

Mr. Charles Barnet, Member of Council, reported the following :—

Account of Burmese Wheat grown at Stratton.

"December 17th, 1859, dibbled 38 poles of gravel land, after tares mown and late turnips fed off; quantity sown, $\frac{3}{4}$ of a peck; in full bloom July 15th; reaped August 27th; produce 12 bushels, weight 61 lbs. per bushel; straw 881 lbs.: cavings and chaff 94 lbs."

Meeting of Weekly Council, Feb. 26th. Mr. Raymond Barker, Vice-President, in the Chair.

Adulteration of Oilcake.

An extract of a letter was read from Messrs. Eyre and Co., of Hull, calling the attention of landlords to the fraud thus committed upon incoming tenants in those cases where they have to pay a part of the outgoing tenant's cake-bill—"unless bran, nut-cake, rice-meal, &c., are as valuable to the land as cakes made entirely from linseed."

Mr. Frere called attention to the importance of steadily maintaining the artificial fertility of the soil for the *economical* production of crops. Allowances to outgoing tenants for oilcake consumed are one important means to this end.

Mr. Fisher Hobbs reminded the Society of a discussion held in that room a few years since upon the subject, when it was remarked by one or two large oilcake crushers, that they made many varieties of cake —even as many as nine or ten different sorts—but that one of them only was a genuine article! He referred to Lincolnshire as a county where the custom prevailed of remunerating the outgoing tenant for unexhausted improvements; and suggested that on some future occasion a paper should be prepared on this subject.

Russian Agriculture.

Mr. Frere next brought under the notice of the Society a concise and interesting report of the proceedings of the Imperial Agricultural Society of Moscow during the year 1860, acknowledging his obligations to M. Sabourroff of the Russian Embassy for explanations respecting Russian weights, &c. Russian agriculture appears to be now undergoing an important crisis, arising chiefly out of the recent emancipation of the serfs. It cannot stand still. It must either relapse—if not utterly collapse—or assume new life and energy from that measure. Most probably the first effect will be unfavourable to agriculture; but in the end it may be hoped that this righteous act will meet with its due reward. Any such crisis in that great empire must exercise an important influence on our imports. On the face of the report of the Imperial Agricultural Society, it is evident that social and financial questions are more urgent in Russia, than those which relate to scientific agriculture. In his opening address, M. Alexander Kochelew, the president, answering the objection that their discussions were not sufficiently practical, says:—"How can we discuss the proper management of woods, when we hardly know whether our forests are our own? How can we improve our stock when our herds are wasted by epidemics and plundered in spite of the police? How can we afford ourselves new implements when we cannot procure that capital which is indispensable? How can we arrange systems of culture when uncertain as to our workmen, whether labour is free or compulsory? And this free labour—are we sure it will not be subject to all kinds of uncertainties by the infraction of contracts on the part of the workmen? All these questions bear more directly at this moment upon rural economy than any other discussion with regard to soils, implements, &c."

The report divides itself into two branches: the first, on "*Questions Economiques;*" and second, "*Questions Pratiques.*" The first question of general economy which came before the Society was a proposal for the establishment of an association of farm-bailiffs; the association being required to stand security for each of its members. It appears that the Society prudently declined to take the initiative in that matter. The next question considered was, that of offering prizes for essays on the best methods of employing free labour. At the

third meeting the Minister of the Imperial Domain expressed the intention of giving prizes to those proprietors who had already introduced free labour, if there were any persons qualified to compete for those prizes—" *s'il y a en Russie des économes pareils.*" At the fourth sitting, M. Chatiloff brought under notice some leading points affecting the Russian agriculturist, viz. the difficulties to which they were exposed by an inadequate amount of capital; the need of a change in the passports furnished to workmen; and the want of power to enforce simple written agreements and contracts. At the same time he gives an interesting calculation of the amount of capital required for farming in different provinces of the empire. In the governments of Riasan and Toula he calculated that a farm of 270 acres (English) would require a capital of 2*l.* 11*s.* per acre; whilst in the government of Moscow 3*l.* 14*s.* per acre would be needed.

In conclusion, it was resolved—first, by a majority of 29 to 10, that compulsory labour is out of the question, as being incompatible with personal freedom; secondly, by a majority of 36 to 1, that this Society, whilst admitting the necessity of introducing free labour, expresses a conviction that, for want of private capital, its introduction would encounter insurmountable obstacles.

At the fifth meeting of the Society the relations between workmen and employer were discussed; and it was proposed that pass-books (*livrets*) must be substituted for passports, and in those *livrets* should be entered the terms of the agreement between the master and his workman. It was further urged that contracts written on plain paper should be made binding; and that a breach of such contracts should be met with prompt punishment, after an oral and public hearing before a magistrate. At the next sitting of the Society, the propriety of instituting model farms in different provinces was discussed; and the committee report favourably on the suggestion, and invite the cooperation of local proprietors and agriculturists. The next point considered was that of drainage and irrigation, in reference to which the office of the Imperial Domain had taken the initiative. Then followed what may be termed a "national grievance;" the question of horse-stealing was brought forward, which it was said could not be put down without a change in the criminal law, and the institution of trial by jury, oral pleading, and publicity at the trial. At the next sitting was considered the importance of the organization of *Banques Territoriales*, as a remedy for the existing want of funds for the payment of wages, and for the difficulties under which the landed proprietors laboured in raising money on the security of the land.

We now come to the "*Questions pratiques*"—the practical discussions; and upon the first of these—the drying of grain—English farmers have still some lessons to learn. It was resolved that every grain must be dried equally throughout; that all the grains should be equally dried; and that so much heat must be applied as will come short of destroying the germ. Out of these questions naturally arose the following points: What is the right temperature for drying?—how long ought the heat to be applied?—what degree of dryness or heat destroys the germ?—what produces the sweating of the grain

after it has been in the kiln?—and lastly (a question which often comes before the English farmer in a damp season), when the grain has been properly dried, how much will it have increased in specific gravity, and how much will it have decreased in volume?

The establishment of a chemical laboratory in connection with the Society's farm,—an offer from an American implement-maker to open a store for the sale of his implements,—the merits of a reaping-machine of home manufacture (the cost of which was to be 26*l*., and which, according to local report (*au dire des économes des pays*), could reap 21½ acres per day!),—experiments with manures and reports upon foreign implements,—were severally discussed. After this, the Society considered whether arrangements could not be made for securing a supply of common salt, duty free, for the use of stock; and whether it might not be so mixed with pitch and tar that it would still be available for stock, although not serviceable for the use of man. The question of horse-stealing then came again under notice; and it was debated whether, in connection with free labour, it was necessary or desirable to send the horses to pasturage, or keep them in stables? whether they should be supplied with green or dry food? and in either case what was the due relation between pasture and arable land? Thereupon it was resolved that, when land is farmed on the three-course, horses cannot profitably be kept in a stable, but must feed on the fallow and in the ravines and forests; but that, where there are artificial meadows and improved implements, horses may be stabled.

The Society has also a department for foreign correspondence, and had received some seasonable information from Bohemia. In that country, when serfdom and feudal service were abolished, attempts had been made to lease lands to farmers, which had utterly failed. The farmers in question did not fulfil their engagements, and utterly ruined the properties; so that the landlords, after experiencing heavy losses, found themselves obliged to break with them, in order to save the remains of their fortunes: an indication this, that some of the obligations inserted in our leases are not quite so superfluous as may be sometimes supposed. On the other hand, it is said that the peasants of Bohemia, being exempt from forced service, farm their own land with tolerable success.

The Report concludes with an account of the Society's own model farm. This farm, situated in the government of Moscow, consists of 712 English acres, and is rented at 40*l*. 3*s*., or 1*s*. 1½*d*. per acre. Of the whole number of acres, 405 were under the plough, 24 held as *métairie*—that is, leased out to peasants on condition of sharing in the fruits—27 in herbs, 68 consisted of wood, 30 of high road, 13½ of farm roads, 108 of ponds, marshes, and copses, and 27 acres were devoted to the experimental field. The course of arable farming was 10 shifts. First year, rye, with a full coating of manure, at the rate of 14¼ tons the acre; second, potatoes; third, oats, with English seed; for the fourth and fifth years, a layer (*herbes fourragères*); sixth and seventh, green crop (*plantes fourragères*); eighth, pasture; ninth, Russian oats; and in the tenth

year, fallow. The ploughing was 5 inches deep; the manure was covered by ploughing without a *coulter*, the field being subsoiled to a further depth of 5 inches. The rye was preceded by vetches and "spergules" (spurry or spurge), sown and fed. The land was broken up in July, sown to rye in August, and the amount of crop grown was 21 bushels per acre. For potatoes, planted with from 7 to 8 tons of manure, about 46 bushels of seed were used per acre, and the crop was 288 bushels per acre. After potatoes, oats were sown on the 5th of May; and a week after, a layer, partly of clover and partly of *laiches (Carex)*, was sown on the oats. Unless this Russian *Carex* is a superior variety, it is a rough sedgy grass, which in other countries would by no means be thought worthy of cultivation. The seed for oats (English) amounted to 5⅓ bushels per acre, and the crop yielded nearly 55 bushels per acre. Grass and clover layer followed, which was made into hay, and produced about 19 cwt. to the acre on an average. They used Nicholson's horse-rake and haymaking machine, and Wood and Dray's mower, in addition to the scythe. After having lain four years under green crops, the field was ploughed in the autumn, harrowed, and sown in the spring with 5 bushels of Russian oats per acre, the produce of which was 30 bushels per acre, whilst the English oats had previously yielded 35 bushels per acre. In this experimental field they grew again the *Carex*, also "spergules," and vetches. They had also a plot of potatoes, to be followed by rye; and if the rye succeeds well after potatoes, that course will be considered remunerative. Turnips have been tried, but failed; being partly destroyed by insects, and partly burnt up by the severe drought in the month of July. Pot-herbs also failed. Besides Wood's and Burgess and Key's reapers, Wood and Dray's mowers and locomotive thrashing machines have also been tried.

From these, which are the chief points in this Report, we gather that the great difficulties the Russian agriculturists have to contend with are, first, a want of capital, implying also a want of borrowing power among the landed proprietors; again, in its turn implying the want of a marketable title, which can only arise from a defective tenure of land, for which the most obvious remedy is that recently adopted in our Indian empire, of giving to the occupiers full and perfect ownership. The defects in the law and its administration and the practical working of the police system in Russia are prominently brought under notice. When we are annually reminded of our large national expenditure for the administration of justice, and when in our respective districts we are sometimes inclined to grumble a little at the demands made upon us for the maintenance of our rural police, it is well not to lose sight of the very intimate connection subsisting between a due administration of justice and the prosperity of agriculture. The proposal to substitute *livrets*, or pass-books, for the old passports of the workmen, is worthy of our consideration. We know, in the case of domestic servants, how desirous we are that they should bring a good character from their last place. The object of these *livrets* is, that they should be a passport to the workman from one master to another, in the same way as the books which are furnished

to journeymen in various trades in this country when they remove from town to town. Perhaps, owing to the operation of our Poor-laws, which give urgent reasons for employing all workmen, good, bad, or indifferent, and therefore paying them all at the same rate, the importance of good character to the agricultural labourer, and the additional value which ought to attach to his services, if he be really a responsible, trustworthy man, has been too much overlooked. In our more advanced state of agriculture it would be a gain if the English workman, instead of being hired annually, with or without a character, at a statute fair, were passed on from one neighbourhood to another with that kind of character which would be implied in the existence of these *livrets*, or pass-books. There is yet another point in which we have also a lesson to learn, viz., What is the practical effect of drying corn upon its bulk? When corn is dried, what is the relation between the loss in volume or bulk, and the increase of weight per bushel, or in specific gravity? Practically the question often arises whether we should sell our wheat in a somewhat damp condition, in August, or wait a week or two, until it had become dry, when it would weigh 1 or 2 lbs. per bushel more, and perhaps realise an additional 2*s.* per quarter, but with a loss of bulk.

Meeting of Weekly Council, March 12th. Mr. Raymond Barker, Vice-President, in the Chair.

Lecture by Professor Voelcker on Milk.

Professor Voelcker said: Milk is essentially an emulsion of fatty particles in a solution of casein and milk-sugar. The fatty matter is not contained in it in a free condition, but enclosed in a little cell, consisting of casein, a substance which exists also in a state of solution in milk, and is precipitated when milk gets sour; in other words, the butter is encased in curd. These milk-globules are of different sizes in different animals; and even in animals of the same kind they vary from the 1-2000th to the 1-4000th part of an inch. They are generally round, but sometimes egg-shaped. Certain yellow spots, called epithelium cells, are generally found in minute quantities even in sound milk. Besides the substances just mentioned, milk invariably contains a certain proportion of mineral matter, which is essentially the same as the incombustible part of bone. The ash of milk is rich in phosphate of lime and phosphate of magnesia, or bone-earth. Butter, curd, milk-sugar, and mineral substances are then the normal constituents of milk. In diseased milk we find a number of accidental substances which, although they cannot always be identified by chemical tests, may generally be recognised by the microscope. This is the case with pus, or corrupt matter; but even the microscope is not able in all cases to decide whether the milk is wholesome or not.

In many instances food contains substances which have a decidedly medicinal effect, and which, passing rapidly into the milk, convey to it the same medicinal properties which the substances themselves

possess. Thus, if an animal takes castor-oil in considerable quantities, the purgative effects of the oil pass into the milk. Colouring matters—the red in madder, the blue in indigo, and the tint of the common weeds *Mercurialis annua* and *Polygonum aviculare*—likewise pass into milk and colour it. In like manner smelling substances communicate a taste; and it is thus that the turnip flavour is imparted to milk.

The white appearance of milk is due to the milk-globules suspended in it. As these globules are separated in the shape of cream, the milk becomes clearer, and acquires a peculiar bluish tint, which is a very good indication of its character. The less transparent milk is, the better, and the more butter it contains. An extensive series of analyses of milk, which I have made, has brought out this fact, that, while the proportion of casein varies but in a trifling degree, the amount of butter or fatty matter in milk is subject to very great variation. The following table will give some idea of the amount of

	Composition of New Milk.			
	1.	2.	3.	4.
Water	83·90	85·20	87·40	89·95
Butter	7·62	4·96	3·43	1·99
Casein	3·31	3·66	3·12	2·94
Milk-sugar	4·46	5·05	5·12	4·48
Mineral matter (ash)	·71	1·13	·93	·64
	100·00	100·00	100·00	100·00
Percentage of dry matters	16·10	14·80	12·60	10·05

these variations. In the first sample you have, in round numbers, no less than 7½ per cent. of butter; in the second, 5 per cent.; in the third, 3½ per cent.; and in the fourth, 2 per cent. These four samples have been selected to show the widest range of variation which I have met with in milk. The first sample, which is an exceedingly rich one, comes from the dairy of Mr. Harrison, of Froster Court; the second sample is richer in butter than ordinary; the third fairly represents the composition of milk of average good quality; and the last, milk of poor quality. They are all four genuine milk, and not produced in any way abnormally. I ascribe the great richness of the first to the extremely good pasture upon which the cows were being fed at a season of the year when milk generally becomes richer in quality, but less in quantity—that is, in September and October, and up to November. Generally speaking, milk is richer in the fall, and poorer in the spring; but if animals are stinted in food in autumn, they yield not only little, but also poor milk. I will now point out the great differences in the composition of the milk of different animals. The following table shows the composition of the milk of herbivorous animals, and one example of the milk of carnivorous animals.

	Composition of the Milk of—						
	Cow.	Human.	Ass.	Goat.	Ewe.		Carnivora (Dog).
Water	87·02	88·94	91·65	85·54	76·70	83·10	67·20
Butter ..	3·13	2·67	·11	4·08	1·20	4·45	13·30
Casein ..	4·48	3·92	1·82	4·52	13·37	5·76	14·60
Milk sugar	4·77	4·33	6·08	5·86	7·10	5·73	3·42
Mineral matters (ash)	·60	·14	·34		1·63	·96	1·48
	100·00	100·00	100·00	100·00	100·00	100·00	100·00

The milk of carnivorous animals is very much the richer in all the various constituents, especially in casein or curd. No other food will at all compare with it. Solid butcher's-meat contains less real nutriment and more water than this description of milk. This will explain at once the extreme difficulty of bringing up a puppy by hand. No kind of food is sufficiently concentrated adequately to provide for the nourishment of a puppy, strong beef-tea being perhaps the most available substitute for that purpose. It is not only the amount of curd, but also that of butter, which is so extremely large in the milk of a bitch. The milk of carnivorous animals has another peculiarity, viz. that it contains no milk-sugar at all. Milk-sugar is very abundant in the milk of herbivorous animals; and, curiously enough, it makes its appearance in the milk of carnivorous animals when, by domestication, they become gradually accustomed to bread diet, and increases with the increased amount of bread and starchy food supplied to the animal. This shows the intimate connexion between the food and the composition of the milk.

Compared with the milk of carnivorous animals, that of the ass appears extremely poor; whereas it shows, according to the table before you, as much as 91½ per cent. of water, it contains but little casein, scarcely any butter, and a small quantity of ash. On the other hand, it is, comparatively speaking, rich in milk-sugar, which is a very digestible material; hence, on the Continent, it is used as medicine in cases of indigestion, especially for children, who take a teaspoonful or two at a time; as an aperient medicine, I do not know any so wholesome for invalids as this lacteine, as it is called. The composition of the milk of a well-fed donkey would, however, be probably more rich than the sample analysed, which was taken from a German donkey, which, like Irish donkeys, lived on the road-side, certainly not on the richest kind of food.

Let me now notice the composition of two specimens of ewe's milk quite recently analysed by me. The first sample I had the pleasure of analysing for his Grace the Duke of Richmond. Having lost many lambs in his flock, his Grace thought it probable that the cause of this was that the milk was poor, or contained something injurious. On carefully examining the milk with the microscope, I found it perfectly normal, showing no symptom of disease. My analysis also

agreed in the main with other published analyses of ewe's milk. But on making the second analysis from the milk of ewes on the College farm, which had lambed about three days, I was struck with the very great difference in quality exhibited, the latter sample containing 30 per cent. of solid matter, whereas in the former we have only 16. I have not learned, in the case of the Duke of Richmond's ewes, what time had elapsed since they lambed—a circumstance which very much influences the quality of the milk; indeed the first milk yielded by the ewe after the lamb is dropped is more like cream than milk. I have reported to the Duke of Richmond that the milk was of good quality compared with other samples of ewe's milk, analyses of which I made, not in England, but on the Continent: it is quite possible that, after all, this milk was of an inferior quality, but we have not sufficient data to establish the fact. It is very interesting to notice the high concentration of the milk of ewes in the first three or four days after lambing, a circumstance which explains the difficulty which is experienced in bringing up a lamb when the mother has died shortly after its birth. I propose now to reserve a couple of ewes, and to analyse their milk from time to time, that I may ascertain what is its average composition, and to what extent it gradually becomes poorer.

The quality of cow's milk is affected by the age of the animal, as well as by the distance from the time of calving. An old cow does not yield such good milk or as much milk as a young one. I have seen an analysis of a very poor milk, analysed in Holland by Dr. Baumbaur, which came from a cow which has had ten calves. Nothing appears so unprofitable as to keep cows for so long a period. Generally speaking, after the fourth or fifth calf, the milk becomes poorer.

Climate also affects the quality of the milk in a remarkable degree. In moist and temperate seasons and localities we obtain a larger quantity, though generally a poorer description of milk, than in dry and warm countries. The quality of milk is thus affected by the temperature, and the amount of moisture in the atmosphere; but something no doubt is also due to the greater amount of water which in wet seasons is present in the produce. That the general state of health and condition of the animal has a marked influence on the quality of the milk, need hardly be stated.

The time at which the milk is taken is said to have also an effect upon the quality. In most agricultural treatises you will find it stated that morning milk is generally richer than evening milk; but my results do not favour that general notion. Out of thirty-two samples which I analysed, taken in the morning and the evening of the same day, I found in eight cases the morning poorer than the evening milk, in four cases I found it richer, and in four there was no perceptible difference. I had taken it for granted that the morning milk was the richer; and indeed the first three analyses which I made confirmed this impression; but, on extending the series of analyses, I found a larger number of cases in which the evening was richer than the morning milk. This was a useful warning against hasty generalisation. The conclusion at which I arrived is, that the time of day has not so much to do with the

matter as the quantity and quality of the food which is given some three or four hours before milking. I have traced this distinctly. At one time I have found the milk of our dairy stock poor in the evening. The cows were then out at grass, and had not a sufficient supply; they received in the evening oilcake and rapecake, and then they produced in the morning richer milk, showing plainly the effect of the food upon the morning milk. At another time, in the winter, I found that, when the cows were fed in the morning and in the middle of the day with barley-meal and rapecake, they produced richer evening milk. I believe then that the quality of the milk is affected by the food, and by the time at which food is given to cows.

The race, and breed, and size of the animal have also an important influence on the quality of the milk. The Alderneys, the Chatelaynes, &c., are too well known to practical men for the rich quality of their milk to need any comment on my part. It is generally believed that thoroughbred cows do not produce so much or so rich a milk as the common dairy stock—that grass-fed stock produces more and a better description of milk. Some experiments which I have made on this subject have given me a rather unexpected result, from which I cannot draw satisfactory inferences.

In the month of September, 1860, I selected three cows from the common dairy stock and three pedigree shorthorns. They were kept in the neighbourhood of Bristol, on what is at present Mr. Stratton's farm, which was then in the occupation of Mr. Proctor, being fed upon good pasture-land. After a time the cows received, besides the grass, 1 lb. apiece of excellent linseed, and in a week's time a second pound was added. I carefully ascertained the quantity and the quality of the milk at different periods, but could not discover much difference in the milk given severally by the two kinds of cows, nor any perceptible change in the quantity or quality given by either when the richer food was supplied. Thus the common cows yielded milk which gave nearly 4 per cent. of butter, and the thoroughbred shorthorns gave a milk of the same quality within one-fifth per cent. The total amount of solid matter in both cases was the same. The quantity of milk produced by the three pedigree cows, kept on grass alone, amounted to 28 pints in the morning and 21 in the evening, making together 49 pints. The common dairy stock produced rather more than 31 pints in the morning and 21 in the evening, making together 52 pints. When they received 1 lb. of cake per cow, the three pedigree cows gave in the morning $26\frac{1}{2}$ pints, and in the evening 22, making together $48\frac{1}{2}$ pints. The three common dairy cows produced in the morning $28\frac{1}{2}$ pints, and in the evening 18, making together $46\frac{1}{2}$ pints. When 2 lbs. of cake were given to each cow, the three pedigree cows produced $26\frac{1}{2}$ pints in the morning and 21 in the evening, in all $47\frac{1}{2}$ pints; whereas the three common dairy cows, with the same quantity of cake, produced 30 pints in the morning and 19 in the evening, in all 49 pints. It follows from this, that, whilst the quality of the milk was not materially bettered, the quantity became slightly less, especially in the case of the three ordinary cows. It would appear,

then, that the additional food had a tendency to go into meat or to produce fat. This shows that we cannot increase or improve *ad infinitum* the quantity or quality of milk. Cows which have a tendency to fatten when supplied with additional food rich in oil and in flesh-forming materials, like linseed-cake, have the power of converting that food into fat; but they do not produce a richer milk, and they may even produce it in smaller quantity. It is this which renders all investigations on the influence of food upon the quantity and quality of milk so extremely difficult. According to theory it would appear that food rich in oily or fatty matter would be extremely useful for producing rich milk; but in practice we sometimes find that it produces fat and flesh instead. Sometimes its influence is even injurious; for cows supplied too abundantly with linseed-cake produce milk which does not make good butter.

A very curious case of this kind was brought under my notice some time ago by Mr. Barthropp. He had milk which furnished cream that could not be made into butter. When put into the churn it beat up into froth; the casein would not separate from the butter, even in the cold weather of January. Mr. Barthropp had given his cows linseed-cake in considerable quantities; and this cake, perhaps for want of being mixed with a sufficient quantity of good dry hay, evidently had the effect of producing too much liquid fat. On trying to separate as much as possible the solid or crystallised fat from the liquid fat, I found that the latter was very much in excess of the former. This is the most striking instance of the influence of a great excess of oily food on the quality of cream, and consequently on the butter, which has come under my notice.

In speaking of the quality of cream, I would take this opportunity of remarking, that bad oilcake, and particularly bad linseed-cake, does a great deal more harm than is generally supposed by dairymen. The inferior taste of the milk is well known. The wholesomeness of the milk of stall-fed cows is further affected by the abominable matters which are occasionally put into linseed-cake. Oilcake-crushers seem now to have the privilege of incorporating any kind of oily refuse with linseed-cake; and since this has been the case, we have heard more frequently of diseased milk, and of milk which has a disagreeable flavour. If cows must have extra food, and linseed-cake be preferred for the purpose, the very best and purest kind of cake will answer best.

Distillery wash, the acid water of starchmakers, and similar refuse, make milk, as is well known, watery; and this dispenses with the necessity of mixing it afterwards with water. Water is not so much added to milk as it is incorporated in the animal system before the milk is produced. It is well known that acid water, and especially water that contains lactic acid, has a tendency to produce an abundance of milk. When animals are fed with concentrated food, such as bean-meal or cake, it may, perhaps, be advisable—in the absence of brewers' grains or distillery refuse,—two materials which contain lactic acid—to generate some lactic acid by keeping barley-meal for some time in contact with water, and by letting it slightly ferment, some vegetable matter perhaps being added, which has a

tendency to hasten the process. By doing this, I am inclined to think that concentrated food like cotton-cake, or bean-meal, or rape-cake, would be rendered more digestible — more readily available for the production of milk of a good quality.

Time does not allow me to speak at length of the influence of various kinds of food on the dairy. I will therefore, in conclusion, only direct the attention of the members of the Society to the different modes of testing the quality of milk.

We have instruments—lactometers, as they are called—made for this purpose; but these lead frequently to erroneous conclusions, being most of them based on erroneous principles. The common lactometer, which is in effect a float, when immersed in milk, indicates by its position the strength of that liquid. Milk which is more dense keeps the float higher: milk which is less dense allows it to sink lower: when water, therefore, is mixed with milk, the float will sink deeper. But there is one consideration which has here to be taken into account. It is this—that the butter in the cream is lighter than the whey of milk. Cream, I find by direct determinations, has a specific gravity of 1·012 to 1·019. It varies slightly. It is a little heavier than water, but lighter than the whey of milk, or skimmed milk. Milk rich in cream would, therefore, be lighter than milk poor in cream. By this lactometer an extra quantity of cream in milk is indicated in precisely the same way as an extra quantity of water. In short, this instrument, which measures the density of milk, furnishes very incorrect results. I cannot, perhaps, make this clearer to you than by giving one or two determinations. In testing the specific gravity of good milk, I found it as follows:—1·030 to 1·032. By skimming off the cream the gravity is increased. The lactometer, again immersed in the skimmed milk, now rises five divisions, and indicates 1·037. But if I take off from this milk the cream, and then put 10 per cent. of water to it, I get again precisely the same specific gravity which the new milk originally indicated, namely, 1·032. I believe that the adulteration most commonly practised in large towns consists in taking off the cream, and then, if the milk be particularly good, adding a little water. This is not indicated by the common lactometer. To meet this objection attempts have been made to construct a lactometer on totally different principles. If the milk is put into a graduated glass and allowed to settle, some of the cream rises, and the quantity can then be read off. In good milk I find from 10 to 12 per cent. of cream by volume; in poor milk there is sometimes as little as from 6 to 7 per cent. These instruments give more useful results than I at first expected, and are useful as a means of making comparisons.

Temperature has some influence on the separation of the cream, but not so great, according to my experiments, as is generally believed. When the temperature is about 50°, most of the cream is separated from the milk in from eighteen to twenty-four hours; and about 7-10ths per cent. of fatty matter remains in the skimmed milk. However long you may keep milk at rest, it is impossible to separate the cream completely; and if the process be conducted at a temperature

of about 50°, a longer time than twenty-four hours will not add appreciably to the quantity separated. But though the bulk of the cream be not increased, it may become denser when the temperature is increased. In comparative experiments, therefore, an equal temperature should be maintained.

The two kinds of lactometers might be used together with advantage: one to measure the amount of cream, and the other to take the density of the skimmed milk. When large quantities of milk have to be supplied to workhouses or public institutions, it is very desirable to have a ready mode of testing its quality. It might be so arranged that, when the milk comes in, some of it should be placed in graduated tubes, and at the end of twenty-four hours the skimmed milk could be drawn off, and a float put into it. This float might be so constructed as to give the proportion of water in the milk from 10 to 12 per cent. I intend to make a number of analyses of milk purposely mixed with water, and to construct a set of two instruments for testing the quality of milk. When the ordinary lactometer, which measures the amount of cream in the milk, is used, practical difficulty is experienced in removing the cream. You might do it with a pipette; but unless you have a very steady hand indeed you cannot get all the cream off: at any rate the servants in a large establishment could not be expected to do it. I have, therefore, thought of using an instrument similar to the alcalimeter of Dr. Moore, analytical chemist of Coblentz. It is a very handy instrument, which is frequently used in chemical laboratories, consisting of a graduated tube divided into one hundred parts, each of seven grains content, the whole being the hundredth part of a gallon. You will by this means get a proportionate part of a gallon. The milk is filled in, and then left for four-and-twenty hours. The cream rises, and can be readily let off in this manner. [The Professor gave a practical illustration with the apparatus.] The specimen before me contains no less than fifteen measures, a large amount of cream. If in London milk you get eight or nine measures of cream, you must be satisfied: very frequently you will get only seven, and even six. In this instrument the skim milk is prevented from flowing out by means of a clasp, and an Indian rubber tubing at the bottom, which, being pressed, allows the skim milk to flow off, so that the cream gradually descends without a particle escaping. I am at present occupied in the endeavour to ascertain if cream is of a uniform composition when gathered in this way. If it is so, then we might form some idea of the amount of butter that a given quantity of milk should produce. There is one other lactometer, or milk-tester, which is simply a graduated cylinder, in which the milk is kept from the influence of the atmosphere. In other respects it resembles the graduated tube; but all the tubes in which graduation begins at the top have this practical inconvenience, that the skimmed milk cannot be removed. Of late I have been endeavouring to ascertain whether the size of the tube affects the quantity of cream which is thrown up, or whether it makes any appreciable difference. As far as I have gone, trying tubes of three sizes, I do not find any difference in the volume. These instruments and investigations, which assume very varied aspects, will continue to occupy my attention.

The Discussion.

Mr. Beale Brown said, he had found by his own experience that it was possible to give additional food to his cows, which tended to fatten them, without making any difference in the yield of cream. He also inquired whether the practice of scalding milk, which was adopted in Devonshire, did not produce a complete separation of the cream from the milk?—to which Professor Voelcker answered, he had no doubt that the scalding of milk would throw up a little more cream; but no amount of boiling would effect a complete separation. Mr. Browne also called attention to a statement in the 'Irish Farmers' Gazette,' that the use of gorse greatly increased the quantity of milk; and suggested that it might be well to resort to gorse at a period of the year when other kinds of food were not abundant.

Professor Voelcker was aware that in some parts of Scotland waste lands which did not bear anything before, are now cultivated entirely with gorse, intended for horses; and he was inclined to think that this, being a concentrated food, might also be given with advantage to dairy stock.

Lord Feversham suggested that further inquiries as to the comparative merits of different breeds of cows were desirable. The Professor had not alluded to roots, but he presumed he would not object to them as winter food. Mangold-wurtzel, carrots, and swede turnips were, he believed, excellent food for winter. True, the turnip might impart a peculiar flavour to the milk, but some persons said that that might be counteracted. Mangold-wurtzel, however, in winter, and early in spring, was certainly an important ingredient in feeding milch cows; and he did not believe that it would be the means of increasing the fat of the animal, but rather of augmenting the quantity of milk.

Mr. Moore said, some years ago he made experiments with Alderney, Shorthorn, Hereford, and pedigree cows, and the result was so far satisfactory that he found little difference between them. He tested in various ways—drawing off the milk by means of a syphon—the quantity of milk yielded morning and evening, at different dates from the time of calving, and found it very uniform in shorthorns, Herefords, and pedigree cows, though there was a great difference in quality. He wished to inquire of Professor Voelcker, whether there was any one particular description of milk-pan that was preferable to another, and whether the depth of the pan was calculated to have any effect upon the quantity of cream that a certain quantity of milk would give forth?

Mr. Cantrell asked of what material the Professor would recommend the pans to be made. In his experience he had found that a common brown earthenware pan, glazed on the inside, threw up more cream than the enamelled iron pans, which he had also used with success.

Professor Voelcker thought that, in reference to the shape and size of milk-pans, shallow vessels were the best. They threw up more cream, and preserved the milk better. Milk could not be kept together to any depth without its getting heated and spoiled. It was an erro-

neous view to take to say that excess of air was injurious to milk. He would recommend that the air should be allowed to penetrate the milk and come in contact with it freely. If they could also maintain a current of air through the dairy, it would be all the better; but damp air resting upon the milk would prove very injurious to it. Recently a little work had been published in Sweden, which recommended that the milk should be exposed in shallow vessels of a peculiar shape and handy construction which freely admitted the air. A part of the author's plan was to have a fire in the dairy whenever it was required; and he was informed that when a thunder-storm was seen approaching, instead of keeping the milk cool, a fire was at once lighted, and steam got up to drive out the excess of moisture. That might seem to be a curious proceeding; but he could readily understand it. It was the damp, moist, heavy air that spoiled the milk. Remove that air by any means, and the milk would keep. It is of the utmost importance to have a dry air in the dairy; and they could now understand why good dairymen always kept the floor as dry as possible. When a thunder-storm approached, the air generally became saturated with moisture, and that moisture had a great deal to do with spoiling the milk.

Mr. Blackburn said he had always found that a small depth of milk threw up the largest quantity of cream, especially in warm weather, when it is important that the cream should be thrown up quickly because the milk would not keep long. In summer he invariably adhered to a depth of 1½ inch, and in winter to one of 4 inches; and the skimmed-milk did not then remain sufficiently long to acquire any acidity. He had found that bean-meal produced a greater quantity of milk than any other kind of food. In comparison with rape-cake and linseed-cake, he found that it contained a larger amount of flesh-making principles than those substances, but not so much oil. Grains, or draft, also produce a large quantity of milk, which appear to contain a large quantity of phosphoric acid. He had fed likewise largely with bran. Between linseed and rape-cake there was great difference. Linseed-cake gave a very unpleasant smell and flavour; whereas rape-cake was more like grass in its effects. The explanation might perhaps be, that the oil in rape-cake more resembled the oil in butter than that in linseed-cake.

Professor Voelcker said that bean-meal contained a considerable quantity of starch; it was an admitted fact that it produced a large quantity of butter. Grains contained lactic acid, and also a large quantity of phosphate of lime, which was held in solution. A certain amount of grains is exceedingly useful for dairy-stock, and so also is bran.

Mr. Blackburn further called attention to a plan for testing milk by its opacity, or rather, the resistance which a body of milk offered to the passage of a ray of light, and thus measuring it. [Professor Voelcker observed that there was such a lactometer; but it was altogether erroneous in principle.] The keeping milk cool is a very important point. He had sent a large quantity of milk twenty-five miles by railway, and it arrived in a coagulated state unfit

for consumption. Formerly it was his practice to have the milk placed in the milk-kits just as it came from the cows, at a temperature of about 90°, and he had frequent complaints that the milk would not keep. He then made several experiments with a view to improvement. Eventually he tried the plan of putting milk in refrigerators, and bringing down the temperature to that of water. That plan entirely succeeded; and since its adoption he had not had a single complaint. It was exceedingly important that milk should be as little agitated as possible, and should not be placed in vessels for transmission before it was quite cool.

Professor VOELCKER said, The tube-lactometer, if applied to test milk that had travelled a considerable distance, would not afford a correct indication of its value or quality, taking the percentage of cream as an index. He had tested milk after a railway journey of forty miles, and found that it produced only one-third of the cream which the same milk had thrown up when taken direct from the cows; this description of lactometer was therefore practically useless when applied to the great bulk of the milk sold in large towns, from the fact of the cream-globules being diffused through the milk, and the low temperature of such milk would also prevent their rising to the surface.

Meeting of Weekly Council, March 19th. Colonel CHALLONER, Vice-President, in the chair.

CATTLE CONDIMENTS.

Mr. BEALE BROWN (Gloucester) said that his motive for bringing forward this subject was a desire to promote a friendly discussion upon matter fraught with great interest to agriculturists generally. He had no connection with Mr. Thorley, and should not know him if he were in that room. Among the different kinds of condiments now advertised, that of Mr. Thorley held the most prominent place before the public; and of that alone was he competent to speak from experience; at the same time he should be sorry to disparage other condiments which might be equally valuable. Scientific men had certainly rather cried them down. Now, with all his respect for science and its followers, he conceived that in this they were decidedly in error. He would presently refer to a little practical experience which he had had with respect to condiments; and so far as that experience went, it showed unmistakably that they were in error on this subject. He was sorry that this should be the case, because he liked to see science and practice go hand in hand, as had been the case to a considerable extent in agriculture. He had for some years used some of Mr. Thorley's ingredients, but thought it unfair to take to pieces a prescription obtained at great pains and expense. What would become of the medical science in general, if such a course was adopted? Dr. Dickson, the first man in the medical profession that set his face against bleeding, who also

introduced tonic treatment, had met with the same reception as Mr. Thorley when, by combining a number of ingredients together in certain proportions, he manufactured a food, which was an excellent tonic for animals, besides its feeding properties.

The prejudice which he once entertained against this food had been thus removed. Two or three years ago, when going abroad, he sold off the great bulk of his sheep, but retained a few favourites. During his absence these animals got so reduced in condition, that about half-a-dozen of them died; of the survivors, some were broken-mouthed and some had no teeth; they were kept on a fine piece of clover. When he again saw them in the spring of the year, they were a perfect bag of bones; and although they were eating oilcake and corn, they did not seem to be improving in the least. Being distressed at this, he bethought himself of Thorley's food, and procured some, without being sanguine as to the result. The food was given with the oilcake and the corn, and the animals improved in a most extraordinary degree; so much so, that, after they had taken it for three or four weeks, he really hardly knew them. When a barrel was exhausted, he left off giving them Thorley's food, and also their supply of corn and cake, and still they did remarkably well. This food seemed to have renovated the whole constitution. When he saw these animals about a fortnight ago, the ewes were in as fine condition as possible for lambing. Some of them had got double lambs.

His interest in agriculture prompted him to communicate these results to this Society, which ought to be open for the free discussion of such subjects. He had been informed that, if the sale of this food increased under the sanction of the Society, its price would in consequence be very much reduced. That would be a very great boon. He had received a pile of letters on this subject from persons who had received benefit, and wished to express their favourable opinion. He should not, however, read these letters, but rather hoped to hear the opinions of other gentlemen who could speak of their own experience. For his own part, he believed Mr. Thorley's invention to be well worthy of attention; he hoped that it would have support from agriculturists generally, and that its price would be so reduced that it would be placed within the reach of tenant-farmers and agriculturists at large.

Mr. Cantrell (Berks) said that in March, last year, his cart-horses were feeding on hay and chaff, and did very badly: he determined to try some of Thorley's Food, though he had been much prejudiced against it. He gave them a little every day, until the green food came, and certainly they improved very much. About a fortnight ago, instead of buying more of Thorley's food, he got a condiment made by Griffin and Co., of Wolverhampton, and was again astonished to see the difference which was produced in his cart-horses within a short time. The quantity he gave was not quite half a pint per day. The carters wetted the chaff, then took a pinch or two, and sprinkled it through the sieve.

Mr. Henry Cotton (Kent) had tried the condiments on an Irish mare which had been sent over from Ireland in a gale of wind. He found her very much out of condition—very ill; but she was so much restored by this food that he was able to hunt her last year. He attributed her improvement entirely to the rapid action of the condiment. He had tried it also on dogs, and was convinced that it did them good after a long wet day. He had tried it also on cows, and found that it produced a very great and visible improvement both in flesh and milk. He had also tried it on pigs with the same result; he had put pigs in two different sties, three in each, feeding one set of pigs with this condiment and the other without it; and those which had the condiment showed a more rapid improvement in their condition than those which were not supplied with it. Prejudice such as that felt against this food is no novelty. When he first introduced steam into Kent he was considered crazy; now he could look out of his window and see seven or eight steam-engines going at once.

The Chairman suggested that if the price of these condiments were much reduced they might be made of inferior materials.

Mr. Beale Brown remarked on the influence which the necessity for advertising exercised on the price of this food.

Mr. Simpson (Birmingham) said that, being a manufacturer of these condiments for cattle, he did not know whether he was quite in order; but his object in attending that discussion was to afford information, not to advertise his own condiments. The credit of being the first maker of these condiments is due not to Mr. Thorley, but to a man named Henri. Analyses of these condiments are not of the slightest use, beyond enabling farmers to detect the presence of any rubbish that was put in them, because their feeding properties are not greater than those of a good sample of oil-cake. Their sole value consists in their health-giving properties, and these must, of course, depend on the proper mixture of the ingredients. This kind of food, though useful as a renovator of old stock, was still more profitable for the young animals. He found that he could rear calves at considerably less expense by giving them this food with skimmed milk than by giving them new milk. He would not assert that skimmed milk with the condiment is better than new milk for young stock. He begged to refer to an article by Mr. Bowick in 'Bell's Weekly Messenger' on feeding calves with condiment. He had tried wheat-flour mixed with condiment, and found it answer exceedingly well. One calf kept for four months in that way, at a cost of 17*s.* 8*d.* for wheat-flour and condiments, exclusive of the milk, did exceedingly well. It was turned out from the 1st of October till after Christmas, to test its constitution, which proved better than it would have been under the ordinary treatment. At fifteen months old it was sold for 10*l.* to the butcher, and killed for beef.

As regarded the price of these condiments, three years ago he guaranteed to deliver an article equal to Thorley's at 18*l.* per ton; and he should be happy to do that now. The only question for

farmers to consider was what such an article was worth to them. The proper course was to sell at a fair market value, and thus secure support, rather than to ask for patronage, in order that the price might be hereafter reduced. Undoubtedly there were great expenses in the trade, such as the cost of advertisements, and a considerable commission to agents; still an article which would give satisfaction might be made at 25*s.* per cwt. With fair competition prices would ultimately find their own level.

Mr. H. S. Thompson, M.P. (Yorkshire), thought Mr. Beale Brown was wrong in assuming that there was any prejudice on the part of the public against Thorley's Food; for he had never met with any evidence of its existence. The feeling against buying the food at its present price was not a prejudice, but rather a conviction that it would not answer to lay out money in purchasing this article. If this feeling could be called a prejudice, Mr. Thorley had himself created it by advertising at such great cost, and professing too much. He gave Mr. Thorley great credit for the variety and ingenuity of his advertisements, for he had never seen more varied advertisements at railway stations, than those illustrations which show the attitude and bearing of a horse before and after taking this food. In his paper and his advertisements Mr. Thorley professed to do more than any food could possibly accomplish. If he could reduce the expenses of his advertisements by some thousands a year, and reduce proportionately the price of the food, he would be more likely to succeed. He (Mr. Thompson) was glad that there was a gentleman present who represented the makers of another condiment, so that they had the question put fairly before them. With reference to the action of the condiment, he had tried it, but on so small a scale, and for so short a time, that he did not attach much importance to the result himself, and therefore he would not ask any one else to do so. As far as it went the result was not satisfactory.

They were all indebted to Mr. Lawes for his experiments. That gentleman had conclusively settled the question whether it would answer to employ Mr. Thorley's condiment on a large scale as *feeding* stuff. But further considerations were involved in this inquiry. They all knew that a man might be so out of health that his food would do him no good, and that a very few grains of rhubarb or quinine given to him when in this state might enable him to digest his food properly, and restore him to a healthy condition. In like manner, looking to the antecedent probabilities of the case, the use of condiment with food might prove a valuable adjunct for feeding cattle when out of health. That question could, however, be settled only by extensive trials on the part of farmers themselves; if the price of these condiments could be materially reduced, and if they could have wide experiments to establish the conditions under which, and the quantities in which, they could be given with the greatest effect, they would then soon be in a position to speak positively upon the subject.

Mr. R. Barker wished to say that some years ago his neighbour,

Lord Camoys, used condiment for his horses and cattle, and found it so beneficial that he had continued to use it, without, he believed, inquiring whether or not he could obtain a similar article at a lower price. No one of his acquaintance kept his accounts more regularly, or took greater care not to incur an outlay for which he was not likely to obtain an adequate return, than Lord Camoys.

Major Munn (Kent) stated, that two years ago some of his lambs were very ill with a consumptive cough, and had a peculiar kind of worm in the throat or the air-passages. His bailiff asked him if he should try Thorley's Food, and his reply was, "Try what you like, they must die." The food was given to a large number of them, and they recovered. It was afterwards tried on another batch which was in bad condition, and they also recovered. He did not watch those cases sufficiently to say that Thorley's Food had anything to do with the recovery of these animals. They were kept in the ordinary way. The lambs were first put out to grass on some salt marshes in the Isle of Sheppey; they were afterwards put in folds on the mainland at Faversham, and then it was that they got that hacking cough, and became diseased. In the autumn of 1860, when one of his farms was let, the incoming tenant disappointed him by declining to take a large number of lambs which were called refuse or worthless. He was told that he would not get more than six, seven, or at the utmost ten shillings a piece for from one to two hundred of them. One hundred and eighteen of these refuse lambs were put into his paddock. His bailiff suggested the use of Thorley's Food. He picked out twenty-five of the worst to begin with. Five of these died within a fortnight, and three others were in such bad condition that they had to be killed. The remainder of them he carried through; some were still at home, and some were sold about two months ago at 45*s.* to 46*s.* apiece. These animals were all kept in the common way, except that they had some bruised beans and peas for a time, and therefore the result might be attributed to Thorley's Food.

He once so much improved a worn-out horse with this food, that he was lent to a butcher on the condition that he was well fed. The butcher was a bad horse-master, and the horse, a delicate feeder, got out of condition again, but a cask of Thorley's Food again restored him to health. He only regarded condiments as restoratives or medicines; whether or not they had any fattening properties as well, was a question into which he did not enter: all he knew was that it had restored these animals under peculiar circumstances, in successive years, and with the same general system of management that the sheep and horses would have been subjected to without this extra food. He might further state that, when he had tried the condiment of another maker on a horse and on some sheep, it produced no effect, although Thorley's Food, subsequently purchased, restored these animals to health. They were all, no doubt, very much indebted to the agricultural chemists for the analyses which they had given, but these only went to show that there were no extraordinary fattening qualities in these condiments.

Mr. Lawes (Rothamsted) did not think anybody who had listened to this discussion could doubt that Thorley's Food had certain beneficial qualities. Mr. Brown and other gentlemen who had stated their experience spoke rather of its merits as a medicine; but the question which chiefly affected them, as agriculturists, was whether these things were beneficial for animals in health; whether, in that case, they would be a good substitute for, or assistant to, natural food. The medicinal part of the question, namely, whether this food was beneficial or not as regarded sick and diseased animals, was a very limited one. He admitted that there were tonic properties in this food. In his experiments, nothing was more striking than the greatly-increased consumption of food to which these condiments led. The pigs consumed a larger amount; but there was no benefit in that, unless they assimilated more food: in this case they got an increased consumption of food without an increase of flesh. If, therefore, the condiment had been given to him, he would rather not use it, because his animals, in order to produce the same amount of meat on barley-meal, ate more.

At the same time that he made these experiments on pigs, he tried also what effect this food would produce on sheep. These experiments were not quite complete, but he would give an outline of the result at the end of sixteen weeks. Twenty sheep were picked out of a very large flock, all being as nearly as possible of the same weight. Five of them were put on linseed-cake, hay, and swedes. They had 1 lb. of hay per day, ½ lb. of linseed-cake, and as much swedes as they liked to eat. The corresponding five sheep received the same amount of hay, but only 6 oz. of linseed-cake, and 2 oz. of Thorley's condiment, and swedes *ad libitum*. The other ten he fed with cotton-seed cake, instead of linseed-cake. He did not find that the sheep ate a bit more food when they received Thorley's condiment than when they did not receive it; the consumption in the two cases was exactly alike; so that the condiment had not the same effect on the ruminant animal that it had on the pig.

The real question was, how much food passed through the animal to produce 100 lbs. increase of flesh? He found that, without Thorley's Food, it required 274 lbs. of clover-chaff, 137 lbs. of linseed-cake, and 3824 lbs. of swedes. With Thorley's Food, it took 285 lbs. of clover-chaff, 107 lbs. of linseed-cake, 3980 lbs. of swedes, and 35 lbs. also of Thorley's Food; the difference between the two being, that in one case it took 4236 lbs., and in the other 4409 lbs.: that was to say, with Thorley's Food, about 200 lbs. more food was required to produce a given increase. The sheep were not yet killed. Still, sixteen weeks' experiments were, he thought, sufficient to give a tolerable idea of what would be the result, the gross amount of the produce being 4536 lbs. without Thorley's Food and 4576 lbs. with it. The difference was not much; still, in both cases, a rather larger amount of food was required to secure a certain increase of flesh when Thorley's Food was used. That result was, he thought, exactly what science would have predicted; there was nothing in science to show that things which had tonic or stimulating pro-

perties were likely to increase the assimilation of food, although they might cause a larger quantity of food to pass through the stomach of the animal.

As food for animals in good health, condiments are not to be recommended; as medicines they, no doubt, had properties of a stimulating character, which would enable animals to digest food when they could not otherwise do so.

Mr. SIMPSON said that a Yorkshire friend of his, a successful pig-breeder, remarked, referring to Mr. Lawes's trials on pigs, that either that gentleman must have selelected a very bad sort of pig, or his barley-meal was of inferior quality, because he could always make his pigs produce a larger amount of meat from a given quantity of barley-meal than Mr. Lawes had done.

Mr. FRERE said, Last spring I was told by my bailiff that two cows, when tied up to fatten, did not thrive as was expected, and had better be sold. I thought, however, that it might be of service to the Society to try them on Thorley's Food, with which they were accordingly fed for three months, being weighed at first every fortnight, and then each month. At the end of three months Thorley's food was discontinued, and the animals kept on for two months longer. Their food was continued precisely the same as it had been for one month before Thorley's food was supplied them, during which month they did not gain in weight. During the first two months when Thorley's food was given them the cows gained in weight, in the third month they remained of the same weight. The gain of one animal for the first two months was 74 lbs. in all, which would be at the rate of 9 lbs. a-week for the first eight weeks, or 6 lbs. a-week over the whole three months. The increase upon the other animal for the two months was 58 lbs., or at the rate of 7 lbs. a-week for the eight weeks, or 5 lbs. a-week for the twelve weeks. During this time each cow gave 6 quarts of milk daily, being, to the best of my belief, an increase of one quart per day upon what it was before administering Thorley's Food; directly we left off Thorley's Food, at the end of three months, the milk fell from 6 quarts to 4 daily, a result which was, perhaps, aided by the time that had intervened from the period of calving. But still there was a more rapid transition than the gradual falling off of milk under ordinary circumstances. This food, whilst it increased the milk, produced no bad effects upon the flavour of the milk and butter. The animals were valued at 28*l.* in the spring, and were sold for 32*l.* in the autumn; they were probably worth as much in July, at the end of the three months, as at the end of five; and if the milk they gave was valued at 2*d.* a quart, they paid for their food during the three months in which Thorley's food was supplied them, and did not pay for their food during the two months afterwards. I consider, then, that condiments are serviceable for stock that is ailing, but not for healthy animals in general.

Professor SIMONDS.—Although this subject is one which is fraught with interest to farmers, many of them are in the habit of making too much of it. Condiments, indeed, are no longer forced upon the notice of the public as food; we hear no more of the concentrated materials

that they contained, for upon that point the experiments of Mr. Lawes have fully satisfied every unprejudiced mind; and there can be no doubt in the world that the nitrogenised materials which these compounds contain are purchased at an enormous cost. The composition of these mixtures is pretty well known, although the exact proportion in which linseed-cake, maize, lentils, &c., are used may be unknown or variable; but then we have the addition of some which may be called medicinal agents, such as cumminseed, carrawayseed, aniseed, and liquorice powder, to which are added some sulphate of antimony, salt, and other substances, many of which are really chemically incompatible one with the other, and do not combine well together. Do, then, these agents really promote digestion and the assimilation of food? I can readily enough understand that they have that effect. Many of them act as invigorators of the system, and therefore enable the animal, if its digestive organs are weakened, by old age or other causes, to digest the same quantity of food in a less amount of time, and consequently to appropriate an increased quantity of food. But I think all this may be attained in a much easier and much safer way. If we took some well-ground linseed-meal, and with that pea or bean meal, or any of those highly nitrogenised matters, and add to them a small quantity of salt—which will simply supply the salts of soda to the functions of the liver, and increase the quantity of bile—and if we add to that any simple stomachic matter in the shape of cumminseed, carrawayseed, aniseed, ginger, gentian, or any of those materials which will act simply as stomachics, then we shall have all we require in these respects.

Farmers, however, are not provided with the machinery required for effectually compounding these mixtures, and may buy them ready prepared to greater advantage; but for agriculturists to be purchasing these so-called condiments at the rate of 40*l.* a ton, is monstrously absurd. I know well, and other practical gentlemen here present can confirm my statement, that such compounds can be sold at from 18*s.* to 1*l.* per cwt., and still leave a profit to the manufacturer.

One word with regard to the experience of Major Munn with lambs that were subject to a special disease. Major Munn has given us facts that would almost lead to the inference that Thorley's Food is a very excellent *anthelmintic*—that, in reality, it destroys those thread-like worms that are situated within the bronchial tubes of the animal. With all due deference to Major Munn upon that point, I would say that Thorley's Food has no anthelmintic properties whatever. The good, therefore, which arose in this individual instance, is simply traceable to those agents which, acting as a tonic on the system, enabled the animal to make a little more blood out of its food than it had done before. A generous diet of corn and cake, with a little salt, would have produced precisely the same effects as Thorley's Food, and at much less cost.

The Chairman.—The great advantage which a discussion of this kind has over the mere reading of written treatises is, that you hear the *pros* and the *cons*. We have had two scientific accounts of this

food—one from Mr. Lawes, and the other from our veterinary professor. Mr. Beale Browne, speaking from experience, has told us that this food of Thorley's is both nourishing and medicinal. Our veterinary professor confirms his statement as to the medicinal qualities of some of the ingredients. So far, then, we are no longer acting in the dark. If any gentleman has cattle that are not well, he will naturally try this Thorley's Food, and at the same time try common food upon animals that are in perfect health. Then, if he brings the two—those fed on Thorley's Food, and those that are fed on common food—to the same condition, he will have established the fact that Thorley's Food is a valuable thing for an animal not in sound health. It remains for gentlemen to try this without prejudice on one side or the other.

Meeting of Weekly Council, March 26th. Mr. W. Fisher Hobbs, V.P., in the Chair.

On Agricultural Steam-boilers and their proper Management.

Mr. Holland, M.P., in introducing this subject, said,—This subject could hardly have been brought with propriety before the Council and Members of this Society a few years ago, when steam was only gradually making its way into use for agricultural purposes. Now, however, that we are not only thrashing, chaff-cutting, and performing other operations by steam-power, but are introducing it into our fields for ploughing and cultivation, it behoves us to have some knowledge of the phenomena connected with steam and water, and also to be cautious how we use what is a most excellent servant if properly dealt with, but a most terrible master if it escape from our control.

The small number of cases of boiler explosions in proportion to the quantity of steam-power used in agriculture arises in a great measure from the perfect way in which boilers and engines are made and sent out by the leading manufacturers, and partly also from the unexpected but gratifying fact that our labourers have turned out to be most excellent and efficient engine-drivers when once initiated by a mechanic who knows his duty, and especially after they have been—say for the first twelve months—well looked after by the master or owner of the engine.

The total quantity of steam-power in agricultural use in England cannot be accurately ascertained; but, according to Mr. Morton, in his 'Handbook of Farm Labour,' it has been increased during the last four years by the addition of upwards of 40,000 horse-power, of which a very large proportion is employed in portable engines, and only a very small percentage in fixed engines.

In dealing with this subject I have not trusted to my own scientific knowledge, but have consulted men of eminence and reputation in the country; and I must be pardoned for calling attention, in a few words, to some of the phenomena of steam itself.

Mr. William Crook, editor of the 'Chemical Gazette,' who has had a good deal to do with the new method of analysing metals by light, in a letter to me, says:—

"There are many subjects connected with the ebullition of water which are not generally known, but which would throw considerable light on many boiler explosions. Any one who has watched perfectly pure water boiling in a clean glass vessel, open at the top, will have observed the tremendous force with which the steam bursts forth at intervals, whilst at intermediate times the liquid is quite at rest. I have sometimes had thin glass flasks shattered to pieces by this explosive force of the boiling water, and that under the ordinary atmospheric pressure. The presence of different chemicals dissolved in the water has considerable influence on this percussive ebullition; alkalies, for instance, increasing the violence; whilst if a gas is being evolved in the liquid, the boiling takes place with perfect tranquillity. A great deal, therefore, depends upon the quality of the water and the mineral impurities which it contains, some waters being quite free from this property, and others possessing it to a dangerous extent. Much also depends upon the amount of insoluble matter (carbonate or sulphate of lime) deposited in the boiler, and upon the state of aggregation in which the deposit is formed—a sandy deposit being of little importance, but a hard stony cake being very liable to give rise to injurious results."

The boilers of *fixed* engines have an advantage over those of *portable* engines, in that they are constantly supplied with the same kind of water and the same quality of coal, or nearly so, and in their being constantly under the care of the same individual, who, as in the dressing of a horse, can work better with an engine in "its own stall," so to speak, than he could with one going about to different parts of the country. But *portable* engines are differently circumstanced, especially when in the hands of persons who have hired them; and their boilers are filled one day out of one ditch, and the next out of another; one day with soft water, another day with hard water; in short, with water of different degrees of impurity. At the same time they are heated with different kinds of fuel; they go through a large amount of weather-wear; they are too often imperfectly cleaned; and from their being hurried from one job to another, they are so frequently neglected as to be additionally liable to accident. Nor is this an unimportant circumstance, for, according to Mr. Crook, as already quoted, a great deal depends upon the quality of the water and the mineral impurities it contains, and a great deal on the state of aggregation in which the deposit is formed.

Water when it boils, has in it a certain quantity of air. If that air be boiled out of it, the boiling is checked. It is a mistaken idea that water boils always at the temperature of 212°; for, according to the degree of pressure, it may either boil at a lower temperature, or be made not to boil, but remain quiescent, at a temperature far higher than 212°. The following extract from a work by Dr. Carpenter shows in a few words how, under certain pressure, water is made to boil, and how vapour is formed:—

"Water without air boils only at intervals, and stops altogether; but if, when it has stopped, air be admitted by means of any solid substance which is put into it, however small the quantity of that substance, it will begin boiling

again. The smallest quantity of air that can be introduced will cause it to boil again."

Now, what frequently happens, I will not say in connection with agriculture, but in connection with manufactures generally, is this: when the men stop for a meal, for instance at dinner-time—they are perhaps doing a job by measure—being very anxious to get the steam up as soon as possible after dinner is over, they take the precaution to keep everything as hot as they possibly can; and although perhaps they imagine that no boiling can take place, and that the engine being at rest is not likely to be in a dangerous state, yet explosions have taken place while the engine has been in that supposed state of rest, from the formation of vapour during a time when the water was actually hotter than when boiling, and yet not boiling.

Accidents of this kind are of very rare occurrence in agriculture, because, as engines are now turned out, something is always made to give way; and if the excellent precautionary rules for the management of steam-engines, given by Mr. Ransome,* and approved by Messrs. Clayton, Shuttleworth, and Co., and other great machine-makers, were observed in practice, we should, I believe, have fewer accidents. One of these rules is very often evaded. Mr. Ransome says:—

"As soon as the water begins to boil, the safety-valve should be opened by hand and examined, to make sure that it is not obstructed in any way; the spring-balance may then be screwed down to about 10 lbs., and when the steam blows off at that point it may be gradually screwed down to 45 or 50 lbs., as the steam rises. *The spring-balance should on no account be left always screwed down to the full pressure when the engine is not at work, and the steam not up.*"

It is to be feared that the spring-balance is too often left screwed while the men are at dinner. On more than one occasion I have myself had to interfere, in consequence of the state in which I have found it; and it has always been a source of anxiety to me that there should be so much ignorance of the effects of confining a large body of steam in a small space. Dr. Carpenter says:—

"The expansion of liquids under the influence of heat increases very rapidly as the temperature is raised, and it is particularly great when the liquid is heated nearly to its boiling-point. The change of bulk is then very great and sudden; for all vapours have many times the bulk of the liquids from which they rose. Thus a pint of water would produce 1694 pints of steam at the ordinary pressure. Though the vaporization of fluids takes place chiefly under the influence of heat, yet the quantity of heat required to produce it is very different under different degrees of pressure. Thus, if we take water at the ordinary pressure as the standard, we should find that any additional pressure (such as would be produced if the vessel were tightly closed) would render an additional quantity of heat necessary to convert it into steam; whilst, on the other hand, the removal of the ordinary pressure of air will cause water to boil at a much lower temperature, as happens on the tops of high mountains, or may easily be shown by the air-pump. Under pressure of the most powerful kind, water has been heated to such a degree that the iron vessel which contained it was red-hot throughout; and if the pressure had been withdrawn in

* 'Journal Royal Agricultural Society,' vol. xix. p. 430.

a very slight degree, the water would have immediately passed into the condition of steam, which, by its very great elasticity at high temperatures, would have blown the vessel to pieces. On the other hand, when the pressure of the air has been entirely removed, water boils at a temperature not above that which it naturally has on a hot day."

As boilers having an incrustation on their inner surface, in consequence of a deposit of the impurities in water, are liable to "burn," it is highly important to prevent such incrustations, and thereby diminish the chances of accident. A discovery with this object in view—it cannot be termed an invention—has been made by Mr. Spiller, the manager of the Chemical Establishment in the War Department, and has been for some time in use in the Government works at Woolwich. The mode of proceeding is thus described:—

"*Chemical Establishment of the War Department, Woolwich, March* 22, 1862.

"*Memorandum respecting the Prevention of Incrustation in Steam-boilers.*—The hard mineral deposits which gradually accumulate on the interior surfaces of steam-boilers owe their formation to the presence of lime and other impurities in the feed-water. By the gradual heating and evaporation of the water these calcareous matters are slowly deposited in a semi-crystalline form, and give rise to adherent crusts, often of considerable thickness and strength, which render it necessary to interrupt the action of the boiler at short intervals in order that it may be opened and cleansed by chipping or some such laborious mechanical means. If, however, a small proportion of crude caustic soda be mixed with the contents of the boiler at first starting, and occasionally renewed during the continuance of its working, this chemical agent will be found to have the property of immediately precipitating, in a granular or sandy form, the greater portion of the lime compounds originally dissolved in the water. These small particles readily subside as a kind of mud, and may be ejected from the boiler by opening the lower 'blow-off' cocks for a few seconds once or twice during the day.

"The dose of caustic soda necessary to be employed for this purpose will vary according to the degree of hardness or the amount of lime in the water: as a general rule, three or four pounds per week will serve for a boiler of 20-horse power. In all cases it will be advisable to keep the proportion at a minimum, since the use of a large excess has undoubtedly an injurious tendency in disturbing the steady and proper action of the boiler. By employing this small quantity of soda, the scale will become so diminished in amount and thickness as to permit of the boiler being used much longer than the ordinary period without inconvenience. There are several methods of introducing the soda. It should first be dissolved in water; and it will usually be advantageous to prepare a solution of known strength—say 3 lbs. in a gallon—which can be measured from the stock as required, and either poured through the safety-valve or pumped in with the feed-water.

"An inspection of the interior of the boiler after a preliminary trial will afford the most satisfactory indication of the economy of the process, and enable a judgment to be formed in regard to the proportion of material to be employed. It is difficult to avoid altogether the formation of a thin scale; but, on opening the boiler, the deposit should be trifling in amount and of so soft a nature as to permit of its easy removal from the iron plates. There is not the slightest possibility of the soda exerting any corrosive action upon the metal of the boiler or fittings; its alkaline properties are known to have a tendency to preserve the iron from rust.

"It may be stated that the system now described has been in operation for some years in the Royal Arsenal, Woolwich, and also at other manufactories in the neighbourhood of London. The application of *caustic soda* for this purpose was made at the suggestion of the undersigned, who is not at the present moment acquainted with any material which is at once so efficient and inexpensive. "JOHN SPILLER, F.C.S."

On the vexed question of the formation of boilers, a gentleman well known to the Society writes to me as follows:—

"It is a singular thing that though we have made great improvements of late in the construction of steam-engines, *boiler*-engineering is very much what it was at the time of Watt; by which I do not mean to suggest that improvements in boilers have not been made since that period, but that, compared with the progress in the construction and management of steam-engines, that of boilers has made comparatively little advance."

In several large towns, such as London and Manchester, there are societies for the prevention of steam-boiler explosions, and duly qualified persons are sent once a month, or at stated periods, to examine the boilers belonging to members. According to the Report of the Manchester Association, there were during the month of January last no less than ninety accidents to boilers, in some shape or other, but of these only eight appear to have been dangerous. The Association, nevertheless, remark in their Report that "incrustation should not be regarded merely as a matter of inconvenience, but frequently of *positive danger*." I do not suppose that in the rural districts we shall ever have such an array of accidents as that reported by the Manchester Association, but we might, I think, as agriculturists, take a lesson out of their book, by forming associations in different districts for the periodical inspection and supervision of our machine boilers and engines. Mr. Fowler is understood to have determined on having an establishment for that purpose at Swindon—a central spot, around which, within a certain area, a great many steam-ploughs of his make are at work; and he intends, for a moderate annual charge, to ascertain, by periodical visits, whether or not these steam-ploughs and machines are in working order. As agriculturists we have not many accidents in the form of boiler explosions, but there are a great many minor accidents connected with steam machinery, which might be avoided by systematic inspection and periodical supervision. A gentleman in Gloucestershire says in a letter to me:—"My brother-in-law, a Gloucester cloth-manufacturer, is guardian of a union, four-fifths of which is certainly manufacturing; but he finds on investigation that the cases which come before him requiring relief on account of accidents are not only relatively, but absolutely, more numerous in the agricultural parishes." A large number of these accidents to individuals arise, I believe, from the valves of steam-engines getting out of order, from the gauges being defective, and from other causes, the remedy for which, if the matter were promptly looked into, would be simple and inexpensive.

The Discussion.

The fitness of well-conducted and conscientious farm-labourers to be intrusted with the care and working of steam-engines, as stated by Mr. Holland, was illustrated from experience by Mr. Dent, M.P., Mr. T. Beale Brown, and Mr. Frere. In allusion to this subject, Mr. Amos, C.E., said that when, after making a valuable engine for a gentleman present, he was consulted as to the choice of an engineer, he recommended that the engine should be placed in the hands of a steady-going labouring man, clean and particular in his habits, who would feel himself flattered by the trust reposed in him, and who, though he might know no more, perhaps, than was told him, would practise that little religiously; whereas, if an engineer were employed, he might, perhaps, be often absent from the post of duty, and thereby cause delay and inconvenience.

The causes of boiler explosions were variously stated.

By Mr. Amos they were attributed more to imperfect construction and careless work than any chemical cause: indeed, he was quite sure that, if the explosions which had occurred had been more carefully investigated and honestly reported on, nine-tenths of them would have been proved to arise either from some fault in the original construction, or from inattention in working. Accidents, when they occur, are too frequently made light of or glossed over. During dinner-hour the boiler is, perhaps, left with a strong coke-like fire under it, with the damper closed and the door open. Under such circumstances, and more especially so in the case of boilers not well constructed, the water might be lifted up in degree, and the starting of the engine or the injection of the force-pump might prove a disturbing cause. The steam might then be generated faster than it could be liberated by the safety-valve, and thus an explosion might ensue, though he was perfectly convinced that none of the explosions he had witnessed had so originated. Mr. Amos agreed with Mr. Holland that an engine-driver cannot be too careful in frequently moving the safety-valve to see that it is in good order. There is a very good method of securing that object in use at the Crystal Palace. The safety-valve is so constructed that it is moved on the opening of either of the fire-doors; and it is impossible to open the doors unless the safety-valve is all right.

Professor Wilson, in reference to Mr. Ransome's rule (p. 430), suggested that it would be much better to open the valves *before* the water boiled than after boiling had commenced, because the greatest risk of an explosion is at the moment when the water begins to boil. It is therefore desirable to open the valve directly heat is employed, in order to ascertain whether or not all is right, particularly in cases where the fire has been drawn overnight, the boiler left charged with water, and the fire lighted up again next morning.

Mr. Amos said, on opening the valve the air is first expanded by heat, and then it rushes out; so long as air is kept in the

boiler there is no danger. During the time the steam is being got up, the fire is in an excited state, and the irregularity of the flame playing upon the boiler has a tendency to keep the water in a state of ebullition; the danger of the water attaining heat without throwing off steam is when there is a steady coat of fire upon it. When the steam is being got up, and the fire is in that state of levity, the opening of the valve is of no use, except to ascertain that the valve is in order.

Mr. Appold said he believed the freer the water is from air, the more likely is the boiler to explode. He had taken water, got rid of the air, and heated the water up to 240° instead of 212°. One day he left it in his room with a thermometer in it, and soon afterwards it exploded, the steam blowing the thermometer out of the flask, so that there must have been a considerably greater pressure than 240°, up to which point he had watched it; from that he arrived at the conclusion that the more free the water is from air, the greater is the danger of accidents. In the case of agricultural engines, on shutting off the water altogether, and allowing a small jet of steam to escape from the boiler, the whole of the air will be got rid of. For a time, if the valve closes, the water thus exhausted of air may lie still, but the moment the pressure is removed, however little, it boils again, and an explosion may follow. If when the engine is at work the pump is kept going so as to pump the air in, there will be no chance of the water getting beyond boiling point.

Professor Wilson expressed his concurrence with the remarks of Mr. Appold, and said the cause of explosions may probably be traced to the fact that, after water has boiled for a time all the contained air is expelled. When a portion of pure water has passed off in the form of vapour, the remaining volume of water is denser than before, because charged with more than its own original share of impurity. When the fire is stopped for dinner or other purposes, not only is the pressure of steam lowered, but the external pressure is increased relatively to the pressure on the valve. Assuming the valve to have been weighted—say to 50 lbs., and the engine to have been working at that amount of pressure; during the cessation of work the pressure on the boiler may have gone down to 30 lbs. or 35 lbs.: relatively, therefore, there will be a greater degree of external pressure than before. If, under such circumstances, the fire be increased suddenly, in the anxiety of the engineman to get the steam up as quickly as possible, the water, being free from air and charged with impurities, and thereby rendered dense, will require to be acted on by a higher temperature before it will generate steam. These circumstances would tend to induce a sudden and tumultuous discharge or burst of steam (as was shown by Mr. Holland's experiments) which, if greater than the valve, probably now not working so freely as at starting, could instantly relieve, would show its effect by bursting through any portion of the boiler not equal to the suddenly increased pressure on its surface. This appeared to him to be the more common cause of the bursting of boilers, which generally may be noticed as

occurring either at starting in the morning or after some period of cessation of work.

In reply to Professor Wilson, it was stated by Mr. Amos that in his opinion no boiler is safe in the present day, unless it has a glass gauge and a gauge cock. The glass gauge is liable to accident, and therefore it is necessary to have two strings to the bow. Many boilers have sustained damage entirely owing to a shortness of water, which is, in fact, one of the chief causes of accident.

The Effects of Impure Water.

Mr. T. Beale Brown remarked that, owing to the hardness of the water in the Cotswold district, steam-boilers fed with it are peculiarly liable to incrustation; but by adding a little lime-water to the hard water, the salts of lime are precipitated, and the water becomes soft. Professor Wilson said the water of the Cotswold district has been found, on analysis, to contain a large portion of carbonate and sulphate of lime. Although the addition of lime to water containing the salts of lime in large quantities for the purpose of purifying it may at first appear paradoxical, it is founded on strictly chemical principles. Pure lime is only sparingly soluble in water: if one dose or equivalent of carbonic acid be added, it is rendered far less soluble than before; but on the addition of a second dose of the same acid, it becomes perfectly soluble. It is in this condition, as a bi-carbonate, that lime, generally speaking, exists in water, and more especially that of the Cotswold hills and all calcareous ranges of hills. By the addition of a small quantity of lime water to the supply water of the boiler the *bi-carbonate* of lime contained in it is reduced to the condition of *carbonate*, and being thus rendered comparatively insoluble will form a precipitate at the bottom of the tank instead of the boiler. The lime water is readily made by mixing fresh burnt lime with *cold* water—say, in the proportions of a teacupfull of lime to a gallon of water.

Mr. Amos said he had found that a change in the quality of the water with which an engine is supplied produces a good effect—the water used one day removing the incrustation produced by that used on a previous day. Peaty water produces in this way a beneficial effect, and so also does the tannin left in bark.

Sir E. Kerrison expressed similar opinions as to the benefits resulting from a change of water.

Professor Wilson objected to the introduction of any vegetable substances into the boiler, as they can only act by decomposition, which (in the case of bran, potatoes, &c.) is very offensive when the valves are opened or the steam is blown off.

Mr. Frere suggested, as a practical remedy for the inconvenience of foul water, that farmers, wherever it was practicable, should have a good circular tank connected with their barns. If barns were properly slated, the tank would in ordinary seasons furnish sufficient water for the engine, and there would thus be an end of the evil and inconvenience arising from impurity.

On the efficacy of caustic soda (or hydrate of soda NaO, HO) in

preventing incrustation, Mr. Amos said, that although he had had no experience of it himself, a friend of his was well satisfied with its action.

Professor Wilson, after stating, that he did not, at once, see how caustic soda would act, said, A few years ago a foreign chemist recommended chloride of ammonium (the common sal ammoniac) for preventing the furring of boilers by calcareous deposits; and the action of this substance is quite intelligible, because when it comes in contact with the salts of lime a double decomposition takes place; the chlorine of the sal ammoniac goes to the lime and forms a soluble salt of lime, whilst the carbonic acid of the carbonate of lime goes to the ammonium, forming a carbonate of ammonia, which passes off with the steam without doing injury. The action of the sal ammoniac is therefore quite intelligible. It is rather expensive (9*d.* to 1*s.* per lb.), but the cost is as nothing when compared with the injury and inconvenience against which it is a protection.*

Sir E. Kerrison said, in the case of the boiler of a fixed engine, one of several which he had at work, a deposit was formed an inch thick, which had to be removed with hammer and chisel. The boiler was not only dangerous, but it had arrived at such a state that it was almost impossible to supply sufficient heat for working. The amount of fuel which was necessary was nearly doubled. He had applied in vain to a distinguished engineer for a means of preserving boilers from incrustation, and intended to try the caustic soda.

The desirability of establishing a society for the periodical inspection of steam boilers used for agricultural purposes was enforced by Mr. Dent, M.P., Mr. Amos, and Mr. Hobbs (the Chairman).

Mr. Spiller in the following letter has further explained the action of caustic soda:

"*Royal Arsenal, Woolwich, August* 12, 1862.

"Since the date of the Society's Meeting in March last—at which Mr. Holland, M.P., did me the honour to communicate a memorandum on the subject of the employment of caustic soda for boilers—I have received and answered numerous inquiries from correspondents who have been anxious to know more of the nature, mode of action, and cost of the material employed. Under these circumstances, I gladly avail myself of an opportunity of making a fuller explanation in regard to my own and other propositions which were then laid before the Society.

"The visitor to the International Exhibition will find in Class II. (Chemical Products) several excellent samples of commercial caustic soda from manufactories in Liverpool, Newcastle, Warrington, Glasgow, &c., priced from 14*l.* 10*s.* to 17*l.* per ton. In smaller quantity, the same article may be procured, at a slightly advanced price, from Messrs. Baiss Brothers, chemists, of Leadenhall-street, London. The properties of caustic soda are such that to keep it dry it requires to be well protected from the atmosphere; but, inasmuch as it will always be used in the state of solution, we are in the habit of

* Mr. Spiller has called attention to the injurious action of this substance on the boiler.—P. H. F.

dissolving it at once in a known bulk of water,—say 3 lbs. or 4 lbs. in a gallon, and keeping this in an iron vessel ready for immediate use by measure.

"For boiler purposes, always employ a small quantity in the first instance, and watch the effect; very little is required to prevent the formation of incrustation, and a large excess is apt to induce a tendency to "priming." Caustic soda does not exert any corrosive action upon the iron boiler-plates and fittings, but inasmuch as it affects the human skin even more than strong washing soda, it should not be handled unnecessarily.

"As to its mode of action: supposing it to be employed with an average sample of river or well water, containing both sulphate and carbonate of lime, it will be found to have the power of precipitating *immediately and in a granular form* those lime salts which otherwise would adhere by crystallization to the surfaces of the boiler. According to chemical theory, one equivalent of caustic soda suffices to precipitate two equivalents of carbonate of lime according to the following equation:—

$$\underset{\text{Caustic Soda.}}{NaO, HO} + \underset{\text{Sulphate of Lime.}}{CaO, SO_3} + \underset{\text{Bicarbonate of Lime.}}{CaO, 2\,CO_2} = \underset{\text{Carbonate of Lime.}}{2\,CaO, CO_2} + \underset{\text{Sulphate of Soda.}}{NaO, SO_3} + \underset{\text{Water.}}{HO}.$$

"It can thus be shown, that in point of economy no cheaper alkaline product is likely to be found than that proposed, commercial samples of which are always priced exactly in accordance with the percentage of true soda which they contain.

"In the discussion upon the use of chloride of ammonium for boiler purposes, it was not suggested that this substance acts injuriously in corroding the iron. With reference to the use of lime for softening water in the boiler a practical difficulty arises from the circumstance that the finely-divided particles of slaked lime are exceedingly liable to cause priming.

"John Spiller, F.C.S."

The following letter from Dr. Voelcker fully supports Mr. Spiller's view, and furnishes a more detailed explanation of the chemical changes which arise from the use of this and other remedies.

"*August* 13*th*, 1862.

"Boiler explosions, I have no doubt, are often produced when the fur which certain hard waters form on boiling is not removed. The fur or incrustation found in boilers consists principally of carbonate and sulphate of lime. It likewise contains fluoride of calcium, some phosphate of lime and magnesia, and oxide of iron. When gradually deposited these constituents of hard waters assume a very hard crystalline condition, and form a regular pan or false bottom, on which the water in the boiler rests without coming into actual contact with the heated iron-boiler. The consequence is that the iron soon burns out, or, in chemical language, becomes oxidised into the black, scaly oxide of iron, which peels off, and gradually renders the boiler so weak that it must burst when the temperature is suddenly raised. I believe in this way boiler explosions are frequently produced. It is, therefore, the aim of intelligent men, and ought to be the aim of every one who is compelled to feed a steam-boiler by hard water, to prevent the deposition of sulphate and carbonate of lime, and other mineral matters in the shape of a hard crystalline mass. This may be done in two ways:—

"1. The deposition in crystalline hard masses may be prevented by the introduction into the boiler of a mechanical disturber of crystallisation. Spent tan and sawdust are as good as anything that may be used. The insoluble salts

of lime (carbonate and sulphate of lime) on boiling and concentration of the liquid in the boiler, instead of gradually separating and collecting into a hard crystalline mass, separate in more powdery particles, which attach themselves to the sawdust or the spent tan, which, moreover, rubbing against all sides of the boiler prevent in a purely mechanical way the deposition of a stone-like incrustation. From time to time the water left in the boiler must be run off, and some fresh sawdust or tan be introduced into it. The light particles of sawdust or tan have another beneficial effect, to which attention was not directed in the discussion at Hanover Square. It is this: these particles, being lighter than water, float on the surface while it is cold; when it boils, they are thoroughly distributed in all parts of the water in the boiler, which has the effect of causing the steam to be given off regularly, without producing sudden jerks. This is a great advantage, for there cannot be a doubt that the more regularly and easily steam is produced, the less chance there is of a boiler explosion—of course, other circumstances being equal. The mechanical agent in this case acts like air, causing steam to be more easily given off.

"2. The deposition of hard crystalline boiler-deposits may be prevented by chemical means. Caustic soda, in my opinion, is by far the best thing that can be used for that purpose. In hard water we have sulphate and bicarbonate of lime—sometimes more sulphate than bicarbonate, and sometimes more of the latter than the former. Caustic soda removes both impurities.

"If bicarbonate of lime only is present, the caustic soda takes one-half of its carbonic acid, and becomes carbonate of soda—a soluble salt which remains in solution; and the bicarbonate of lime (a soluble salt) loses half its carbonic acid, and becomes changed into insoluble or neutral carbonate of lime, which is deposited. Professor Wilson, who explained so well the effect of lime-water on hard waters, I have no doubt will notice the analogy between the action of caustic soda and caustic lime—for lime-water is merely a solution of caustic or quick-lime in water. The principle of their action is precisely the same. In one case we have in solution—

Bi-carbonate of soda, $Ca\,O,\ 2\,C\,O_2$ 1 equivalent of lime + 2 of carbonic acid.

or $Ca,\ C\,O_2$ + | $C\,O_2$, and if we add $Ca\,O$ = 1 equivalent of caustic lime,

we obtain

$Ca\,O,\ C\,O_2$ or insoluble carbonate of lime. | + $Ca\,O,\ C\,O_2$ insol. carb. of lime.

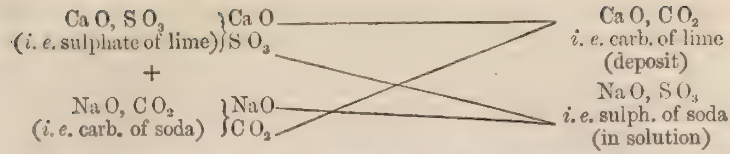
In the other case to

$Ca\,O,\ C\,O_2$ | $C\,O_2$ *i. e.* bicarb. of lime, we add $N_a\,O$, *i. e.* caustic soda,

and obtain

$Ca\,O,\ C\,O_2$ *i. e.* insol. or neutral carb. of lime, + $Na\,O,\ C\,O_2$ *i. e.* soluble carbonate of soda.

"If the water, as is generally the case, contains sulphate as well as carbonate of lime, the sulphate is likewise deposited by the addition of caustic soda. In the first place we obtain, as shown just now, insoluble carbonate of lime and soluble carbonate of soda; but in the next place the carbonate of soda and sulphate of lime, by mutual exchange of their acids, become carbonate of lime (which falls down) and sulphate of soda (which remains in solution):—



"In Clarke's process, by which a good deal of lime is removed from certain hard waters by means of lime-water, *i. e.* a solution of caustic lime, the lime is only separated from the bicarbonate, and not from the sulphate of lime (gypsum).

"In like manner, by sal ammoniac or chloride of ammonium we can only remove the lime from the bicarbonate of lime, but not from the gypsum, and hence caustic soda is superior both to lime-water (Clarke's process) and to the sal ammoniac process. The beneficial action of the caustic soda when added to hard water does not consist in the prevention of insoluble lime-combinations, but in the almost instantaneous precipitation of these compounds in a *finely divided pulverulent condition.* Sal ammoniac prevents the deposition of carbonate of lime, inasmuch as it forms with the carbonic acid of the carbonate of lime volatile carbonate of ammonia, which passes off with the steam, whilst the chlorine in the sal ammoniac forms with the lime chloride of calcium, a very soluble salt which remains dissolved in the boiler. But, as stated already, sal ammoniac has no effect on sulphate of lime. Altogether, caustic soda is not only the most efficacious, but also the cheapest means for preventing boiler incrustations."

Some facts connected with this subject seem worthy of record in this Journal. For instance, in a steam boiler at Ems there was no trace of incrustation after several months' wear, although the water with which the boiler was fed contained not less than 21·899 grs. in the pound of solid matter. On analysis, the following results were ascertained :—

	Grs.
Carbonate of soda	11·35488
Sulphate of soda	0·10790
Chloride of sodium	7·27020
Sulphate of potash	0·43653
Carbonate of lime	1·24370
Carbonate of baryta	1·06890
Carbonate of iron	0·01728
Carbonate of manganese	0·00868
Carbonate of baryta and strontia	0·00215
Phosphate of alumina	0·01090
Silica	0·37839
	21·89951

Fresenius inferred from this that it is not carbonate of lime, but only the *sulphate of lime* which causes the formation of crust, and he attributed the absence of incrustation in the instance under review to the action of the *soda* contained in the water. Starting from this point, he instituted an elaborate series of experiments, and from these he ultimately arrived at the conclusion that the addition of SODA is the simplest means of preventing incrustation (*vide* Journ. für Prakt. Chem., lviii. p. 65, quoted in the Pharma-

ceutical Journal). Another method of preventing the incrustation of steam boilers by water containing the sulphate or carbonate of lime or magnesia is to treat the water with hydrate of baryta. This remedy has been the subject of one or more patents, but it is objectionable owing to the poisonous quality of the water so treated.

But incrustation, though a fertile source of inconvenience and danger, is not the sole or principal cause of boiler explosions. According to Mr. Amos, explosions generally arise "either from some fault in the original construction of the boiler or from inattention in working." And this opinion is strikingly confirmed by Mr. L. E. Fletcher, chief engineer of the "Manchester Association for the Prevention of Steam Boiler Explosions," who in his monthly report, dated May 27th in the present year, thus expresses himself:

"It will be seen that all the above explosions [of the month] occurred from the most simple causes, and that no mystery whatever need be attached to any of them; while by suitable construction of the boilers in the first place, and due attention to their state of repair in the second, these explosions would in every case have been prevented.

"I am extremely desirous to keep this practical view of steam-boiler explosions constantly in sight, since I am persuaded no head will be made against them generally as long as their causes are considered to be matters of mystery, and their occurrence one of chance.

"Very few of the explosions that come under my notice occur from shortness of water, and I believe that to be a much-abused idea, and the number of explosions resulting from it to be much exaggerated. It appears to be an almost stereotyped verdict at inquests, and, the boiler attendant being frequently killed, there is seldom any witness to the contrary.

"I find that by far the most frequent cause of explosion is the insufficiency of the boiler for its working pressure, either on account of its original construction, or state of repair consequent upon use; while those explosions resulting either from deficiency of water or from extraordinary or reckless pressure are comparatively rare. In other words, to prevent misapprehension, I find that explosion is more frequently due to weakness of the boiler than to excessive pressure of the steam."

Under these circumstances it is highly satisfactory to know that the most simple and efficacious method of testing steam boilers is by the application of hydraulic pressure. On this point the remarks of Mr. Fletcher are especially valuable.

"I know no means of ascertaining the sufficiency of the original construction of a boiler, or of testing the weakness produced upon it by wear and tear —in short, of testing either new or old boilers—equal to the use of hydraulic pressure, and think all steam-users would do well to make systematic use of this test once a year. In France, I believe, this plan is rendered compulsory by the Government, and it would be well were it generally adopted in this country voluntarily. Weak places in the plates may pass undetected, even on careful examination, while some parts may be inaccessible and concealed from view; but the hydraulic test is sure to detect and expose them all. Its timely application would have saved that most disastrous explosion which occurred some time since, here in Manchester, at a locomotive establishment second to none in the kingdom for its high reputation; and since a defect passed unnoticed at such an establishment, where the construction of boilers, as well as the quality and strength of plates, may well be supposed to have

been thoroughly understood, it surely argues the necessity of the hydraulic test being generally applied.

"Mr. Muntz, a steam-user in Birmingham, states, in a letter published on the Millfield boiler explosion, that he has for years adopted, with advantage, the plan of an annual hydraulic boiler test, and considers it a duty he owes to his workmen in consideration of their safety.

"The application of the hydraulic test is so simple, and the pump required so small, that each steam-user could provide himself with one at very little expense, or some parties might find it worth their while to take up the proving of boilers by water pressure as an itinerant speciality of engineering practice. This Association would be glad to assist in the general application of the hydraulic test by inspecting the boilers when under pressure, and I feel convinced that, were the practice of this annual test generally adopted, which I trust it soon will be, explosions would become nearly, if not entirely, extinct."

Meeting of Weekly Council, April 3rd. Sir Edward Kerrison, M.P., in the Chair.

On the Growth of Mangold.

Mr. Frere, when introducing the subject, remarked, that mangold is, for two reasons, an especially valuable crop, because it bears both forcing and storing. If we try to force our corn crops to any considerable extent, there is a danger, from the increase of straw, and from that straw being lodged, that the yield of grain will be decreased instead of increased, and a loss of quality likewise incurred; whilst there seem to be hardly any bounds to our power of increasing the crop of mangold, unless it is intended for the manufacture of sugar. Again, it is a most valuable plant in respect of storing. The question how to ensure a succession of green food might be difficult to answer but for the mangold. The mangold-store is a bank upon which the farmer can draw at any season of the year; and so long as it lasts he need be under no apprehension of injury from a gap occurring between any other two fodder crops.

The immediate object of the experiment he had to communicate was to test the value of Lawson's artificial guano against the Peruvian guano, of which the supply is much restricted. 4 cwts. of Lawson's and 4 cwts. of Peruvian were each mixed with 4 cwts. of common salt, and strewed on the ridges before they were split in the spring. Alongside of these were tried 10 tons of farmyard manure, also with the addition of 4 cwts. of salt, and a mixture of 6 tons of farmyard manure, with 2 cwts. of Peruvian guano and 2 cwts. of salt. The cost of both Lawson's and the Peruvian guano may be taken at 2*l.* 10*s.* per acre, and, when spread on the ground, farmyard manure at 8*s.* a ton. 1½ cwt. of superphosphate, with 15 bushels of burnt ashes per acre, were in every instance drilled in with the plant, in accordance with the general practice of the farm; Lawson's guano being regarded as a substitute, if not an equivalent, for the Peruvian—a step taken in accordance rather with the name given to the artificial manure than with scientific analysis. The mangold was all drilled on the 25th of April. Before coming to results, some account

should be taken of the season, on which those results may have materially depended. The year 1861 was showery until the 9th of July; but from that time we had a scorching summer, almost without any rain until the 1st of October. Consequently many fields of white turnips, drilled with artificial manures, came up well, and were singled out well, but in August were quite burnt up, the brown cinders of the dead plant alone showing the line of the drills. The mangolds came up well, the seed being good; so that, to complete the plant, not one root in fifty had been transplanted. Their growth was steady, but not rapid; the leaves of some few weakly plants alone being affected by the blight which was so prevalent in other parts of England.

When the rain came on in October, the piece manured with Lawson's guano appeared already somewhat exhausted, and the leaves had begun to turn, whilst that manured with Peruvian guano still retained its full vigour in the leaf; there was therefore a much greater increase of growth and of weight in the month of October on the acre manured with Peruvian guano, and that which had the mixture of guano and farmyard manure, than on the acre manured with Lawson's guano. When the crop was taken up, three drills were selected on each piece, as impartially as could be, and they measured 17 poles. The weight per acre was from Lawson's guano only 14 tons 18 cwts.; from the Peruvian guano, 22 tons 2 cwts.; from farmyard manure, 16 tons 14 cwts.; and from the mixture of guano and manure, 21 tons 15 cwts. These results were no doubt in great measure due to the season, in connexion with the tendency of guano to produce a much larger development of leaf. Farmyard manure and the guano, when tried four years ago on nearly the same ground, gave the same weight of bulb, but the guano much increased the weight of leaf. This tendency to force the leaf is of special value in a hot season, because when the soil is dry the plant is much more thrown upon the resources afforded by the atmosphere, of which the leaves are the recipients. Now, probably, in a very dry season, such as was the last in one part of England, the plant derives as much of its growth through the medium of its leaves as it does through the medium of its roots; at all events, in a dry season, with this plant the proportion of the increase due to the leaf rather than to the root is much larger than in the rainy season.

It is always of importance with respect to any experiment to look back to the previous crops and to the condition in which the ground is left. In 1859 this land was in Giant Sainfoin, which had been sown as a layer with barley. It was mown once, and fed off twice; the first time with ram lambs eating corn and cake, and afterwards by the flock of ewes. When the sainfoin was being mown green, it was ascertained that the amount growing on 22 poles was 1 ton 84 lbs., the quantity mown in the day for feeding 15 cart-horses (at which rate a cart-horse was eating 1 cwt. 3 stone per day). At the same time 1½ ton was being mown daily for the cows and bullocks, and fed 21 head. They were, therefore, eating 1½ cwt. a-piece per day: there were nearly 8 tons of sainfoin per acre in its green state, which was probably equivalent to about 2 tons of hay. It is worthy of remark, that the sheep-folding being considered a sufficient preparation

for wheat on those plots where mangold was grown with Peruvian guano, there had been no straw manure for probably four or five years. Mr. Lawes has expressed an opinion, that mangold, to be grown successfully, must either have farmyard manure applied to the crop before it is sown, or at all events to the previous crop. It will also be desirable to look forward as well as backward. Where the farmyard manure was applied last year, the leaves are ploughed in; and I shall reckon on growing barley this year without further dressing. Where Lawson's guano and the Peruvian guano were applied last year, there I shall deem it desirable to add a further dressing of 2 cwts. of guano for this year's barley. My proximate estimate for the barley crop is, on the adjacent land where I grew swedes, 46 bushels of barley per acre; after a double dressing of Peruvian guano 40 bushels, but of a somewhat inferior quality. Where the farmyard manure was applied last year, and no further manure is added this year, I expect to grow 36 bushels, but of a superior quality to that which follows Peruvian guano. If on the plots manured with Lawson's and Peruvian guano for mangold, barley had been drilled this year, without any further dressing, I should only expect to reap about 30 bushels. And after all we should rather anticipate that the layer will be quite as good where the farmyard manure was applied three years ago, without further dressing, as where a double dressing of guano had been applied. If then you give a dressing of guano directly to the mangold, and then afterwards to the barley, the cost will be nearly identical with the single application of farmyard manure; for the first dressing of guano will cost 50*s*., and the next about one-half of that, or 25*s*.; whilst I estimate a single dressing, amounting to 10 tons of farmyard manure, at only 80*s*., or a crown more.

One word on the preparation of land for mangold. Prompted in great measure by Mr. Pusey's teaching, at one time we used to be anxious to get some stolen crops in directly after harvest; but cold springs and dry summers prevented those crops being of such use to us in the Eastern Counties as they are in the Southern and Western districts. Now our first object after harvest is to prepare the land for mangold. This field was first ploughed, twice dragged, and then worked with three horses in a harrow in the month of September. After wheat-sowing in November, it was all ridged up; then the plough was worked between the ridges as deep as three horses could draw it, and the field left until spring. In the spring the ridges were only just picked over to take the weeds out. The manure was then put in, and it only required to be split. A like course was adopted in 1861, and its importance exhibited in the wet spring of 1862.

The Chairman, Sir Edward Kerrison, laid before the meeting two sets of experiments made by Mr. Horn, his bailiff, on his own farm, and remarked that beetroot is now being much more largely grown than formerly, particularly in the Eastern Counties, where a considerable breadth of swedes has been discontinued in its favour; the dryness of the summer season there having led to the crop of swedes being constantly destroyed by the fly:—

Experiments in 1856.

The following experiments were conducted on a poor gravelly soil, in order to ascertain the effect of artificials applied loosely on each crop sown the 21st of May, and raised the 12th November, 1856 :—

Manures per Acre.	Produce. tons.	cwt.
1. 20 loads well-prepared stable-dung, and 4 cwt. of guano	23	16
2. 20 do. do. 4 cwt. guano, and 5 cwt. salt	30	12
3. 20 do. do. 1 cwt. guano, 1 cwt. superphosphate, 1 cwt. blood manure, and 1 cwt. salt	25	10
4. 40 loads of dung	21	3
5. 2 cwt. guano, 2 cwt. superphosphate, 2 cwt. blood manure, and 2 cwt. salt	20	6
6. 7½ cwt. guano	17	17
7. 12 cwt. superphosphate (Lawes')	14	19
8. 13 cwt. blood manure	15	6
9. 1⅓ cwt. guano, 1⅓ cwt. superphosphate, 1⅓ cwt. blood manure, and 1⅓ cwt. salt	19	11
10. 5 cwt. guano	12	15
11. 8 cwt. superphosphate	11	18
12. 8 cwt. blood manure	12	11

This experiment shows most distinctly that a combination of farm-yard manure with some species of artificial manure is generally the best method of obtaining the greatest amount of mangold.

Experiments in 1860.

The following experiments were conducted on the crop of 1860 in order to ascertain which manures would raise the greatest weight per acre of mangolds in conjunction with farmyard dung. Field, a light soil; seed drilled on 27-inch ridges first week in May; dung applied in the ridge at time of sowing; the artificials sown by hand over the dung to insure equal distribution; crop stored in the second week of October :—

Manures per Acre.	Produce. tons.	cwt.
1. 20 cartloads of good dung	16	4
2. 20 do. do. 2 cwt. guano, and 4 cwt. salt	28	14
3. 20 do. do. 4 cwt. blood and bone manure, and 4 cwt. salt	24	9
4. 20 do. do. and 2 cwt. guano	21	15
5. 20 do. do. 4 cwt. superphosphate, and 4 cwt. salt	22	10
6. 20 do. do. and 4 cwt. salt	20	4
7. 20 do. do. and 4 cwt. Lawes' superphosphate	18	10

In this latter series of experiments the dung was applied at the time of sowing on the ridges. That is a matter which must depend very much on the soil. On heavy soils, which it is difficult to get upon at certain seasons, the early application of manure is no doubt excellent; but on lighter soils it is better to put it on the ridge just before sowing the seed. This series of experiments, taking the value of the produce at 12*s.* 6*d.* per ton, which is a fair amount, and allowing for the cost of the application, gives the highest gain to the 2 cwts. of guano and

the 4 cwts. of salt, or 6*l.* 4*s.* 6*d.* the acre. The next highest gain is from the application of 4 cwts. of blood and bone manure and 4 cwts. of salt; in both cases the advantage of applying salt in conjunction with either guano or artificial manures was clearly shown. Similar results have attended the experiments made by Mr. Keary; and the practice of mixing farmyard dung with artificial manures is generally adopted in Suffolk as the safest and best mode of applying those manures, which yield a great increase of produce when applied in conjunction, but not so when used separately.

The Discussion.

In the discussion which ensued the following topics came under consideration:—

1. The advantage of applying the manure in autumn, or to the previous crop.
2. That of using a combination of manures.
3. The possibility of growing mangold for several years consecutively on the same ground.
4. The benefit derived from salt.
5. The best width between the drills.

Autumn Application of Manure.

Mr. Holland remarked on the smallness of the crop grown, which, being ignorant of the nature of the climate and soil, he was disposed to attribute to the farmyard manure having been put in at the same time as the seed. If it had been mixed with the soil in the autumn, it would have been out of the way both of the seed and the root. He considered that a great quantity of mangold is destroyed in shape and in value from the bulbs being in contact with the long straw, &c., of farmyard dung. After the seed-bed has been got into nice order in the autumn, so as to require little further cultivation, the trampling and pressure caused by laying on manure in spring does it considerable harm. The bringing up of fresh soil at this time is also undesirable. These remarks, however, would only apply to mangolds grown on heavy soil. The soil with which he was acquainted was so stiff that the only way to fit it for a root-crop was by burning, so as to effect at once a mechanical and a chemical change in its properties; though much vegetable matter would be burnt, the phosphates and salts remaining in the ashes would act the more effectually upon the crop.

The Combination of Manures.

Mr. Holland further called attention to some remarks of Mr. Pusey on the advantage of combining manures. Mr. Pusey writes:—

"The inference arrived at (from the experiments) is, that it is more profitable to use some artificial manures in conjunction with dung than to use either singly. Thus, guano and woollen rags used singly added to my crop only 5 tons per acre; the single dressing of dung added only 11 tons, and doubling that amount of dung did no good. But guano combined with the same amount of dung, and rags combined with the same amount of dung, each gave an addition, not of 16 tons of roots, according to their effects when

used singly, but of 20 tons, yielding each 36 tons—a produce very large indeed for land which, four years ago, when I took it in hand, was said to be incapable of growing a turnip."

Sir Edward Kerrison, whose experiment led to the same conclusion, expressed his determination of henceforth using every year 2 cwts. of guano with 4 cwts. of salt in addition to farmyard manure.

Possibility of growing Consecutive Crops of Mangold.

Mr. Holland also referred to a paper which was read before the Council of this Society in the year 1852, by Mr. Gaddesden, giving an account of a visit he had paid to a Mr. Reeve, living near Leatherhead, in Surrey, who had grown mangold without manure for four years, and yet had a very promising crop to show:—

"The land on which the beet was grown appeared to be of a good and useful character, bearing at the time of Mr. Gaddesden's visit a very promising plant of wheat, and was stated to have had no manure upon it for four years. Mr. Reeve attributed his success in growing the white Silesian beet to his thus not applying manure directly to the crop, and stated that when he had dunged for the beet the bulbs proved small, had a large mass of fuzzy fibres, and gave but a small weight per acre, viz. 15 to 18 tons; but that since he had put his manuring matter further off the beet crop, he had raised large fine roots of a great weight per acre. He regarded this circumstance as a discovery in the culture of this plant, and Mr. Gaddesden considered that if Mr. Reeve's calculations were realised it would be so. Mr. Gaddesden was shown the field which Mr. Reeve intended to sow with Silesian beet in that week. The soil was a heavy clay; certainly not from its aspect very promising."

Mr. Cantrell said, that some twenty years ago, when he occupied a farm at Windsor, since held by the late Prince Consort, he was induced to try mangold on a field which had not been under cultivation for some time previously, and grew them successfully for four years in succession, the produce increasing every year. The land was ridged up in autumn, and so left in the winter; in spring a moderate dressing of dung was applied, guano and superphosphate being then hardly in use. The leaves were removed from the land and given to stock. He was not acquainted with the present condition of the land. At that time the East Berkshire Agricultural Society had a prize for mangold placed at its disposal by Mr. Palmer, late member for the county. Mr. Palmer and Mr. Cantrell alternately carried off the prize.

Mr. Peel stated, that he had grown good crops of mangold on the same land for six years in succession. For the first two or three years the roots increased in size; they then seemed to have reached their maximum. In 1861 his neighbourhood had been as much oppressed by wet as that of Mr. Frere by sunshine. The land was consequently less well prepared, and the crop not so good as before. The field in question has rather a light soil and a strong subsoil; it had been trenched with a fork two spit deep before the first mangold crop was grown; it also had been twice drained. The first draining was unsuccessful because the sod, which had been inverted over the tile at a depth of from 3 to 4 feet, had grown so that its roots quite

choked the channel, and it became necessary to relay the tiles. Manure had been applied each year, and the land was now too rich to grow corn, so that he continued to sow mangold, not knowing what else to do. Mr. Peel further stated that a friend of his had grown mangold upon the same ground for seventeen successive years. Such a fact is of practical importance in pastoral districts, such as the grazing-grounds in the North of England, because it is desirable to grow as near to the homestead as possible a crop which, like mangold, requires much labour and attention.

The Benefit derived from Salt.

It appears, from Sir E. Kerrison's experiments and remarks, that in his neighbourhood salt seems to be valuable as a direct food for the plant. Mr. Frere, living on the chalk stratum, a marine formation, believed that his soil already contained a sufficient supply of salt, but added it to the guano, &c., partly for the convenience of sowing, and partly in the belief that it might produce a chemical action on the other fertilizers, which would make them better adapted for assimilation by the plants.

The proper Width for Drilling Mangold.

Mr. Wells inquired whether on a clay soil a nearer or a more distant drilling is advantageous, and called attention to a statement of Professor Voelcker, in a recent number of the 'Journal,' which advocates drilling on rich soils much nearer than on poor soils—a principle which a writer in the Highland Agricultural Society's 'Journal,' for March, 1861, protests against. On this point Mr. Peel said—I began with 27 inches. I then got to 30. Still that was too small. I next got to 32, and ended with 36. But as in the latter instance the wet summer prevented the mangold developing itself, I believe I should have had a heavier crop if I had put it nearer. If you want to grow a root from 16 to 18 lbs. weight, I don't think that it will, according to my limited experience, be developed to that magnitude in rows much less than 3 feet apart.

Mr. Holland called attention to the greater facilities for hoeing as well as for the more free development of root afforded by the greater width.

Mr. Frere said, that the observation of Professor Voelcker had attracted his attention at the time, and that he was not prepared to concur in it.* If the roots are intended for storing, the larger the root and the smaller the number to be taken up the more conveniently are they stored, and, up to a certain point, the more valuable are they for the stock. After all, the problem is not to grow marvellous specimens, but to combine the maximum weight per acre with good quality.

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* The stature of the plant, or even animal, varies with the spot of its nativity. The richer the soil, the more genial the climate, the larger is its natural development. Give what space you will to a root on a hungry soil, and you may only expose it to the taunt, "Non si te ruperis, par eris;" Grow till you split, but you'll never make a large sound root.—P. H. F.

In France, where mangold is employed in the manufacture of sugar, a moderately-sized root is much preferred to a large one; and a crop of 14 or 15 tons per acre is all that is desired. The worth of the large root may be dependent upon the length of time during which it is stored; and there may be some analogy between the ripening of mangold and that of our choice pears.

Meeting of Weekly Council, April 30th. Mr. Raymond Barker, Vice-President, in the Chair.

Cooking Food for Cattle.

Mr. Frere said, This question chiefly affects the arable farms on which a great breadth of straw is grown, which is to be converted into manure, and the problem is to make that straw, as far as possible, profitable for food. In Professor Voelcker's paper on Straw in the last number of the Journal, this passage occurs:—"It is undoubtedly a fact that some practical feeders are in possession of the secret of converting considerable quantities of straw into beef. What this secret is, perhaps, is not known even to themselves. It may be that the combination in which straw is given, or the preparation to which it is submitted before it is placed in the food-trough, has something to do with the success that attends its use; but it is yet more probable that on farms where straw is economically cut into chaff and given to cattle, its condition, from early harvesting and other influences, is better than in other localities, where a practice prevails of allowing corn to become over-ripe before it is cut." Professor Voelcker in his paper also points out that straw contains albuminous compounds varying from $1\frac{1}{2}$ to 3 per cent., oil from 1 to 2 per cent., the remainder being woody fibre; and the inference is, that straw cannot rank high as a heat-producing material, unless the cellular and woody fibre can be assimilated. He further remarks, "That this is so in grass, clover, and roots, there can be no doubt." He then, led by the analogy of the digestive process in animals, tries the effect of treating the straw with dilute acids and alkalies, and finds that by this means a considerable quantity of the woody fibre, which is insoluble in water, is rendered soluble; in wheat-straw as much as nearly 20 per cent., and in oat-straw, under favourable circumstances, a more considerable quantity; there remaining in wheat-straw 54 per cent. which these diluted acids cannot act upon, but which, he remarks, the animals may still be able to digest in part. To the inquiry whether the farmer should attempt, in like manner, to employ these mineral acids in preparing the straw, the Professor's answer is distinctly in the negative: his aim should rather be to produce a vegetable acid, such as lactic acid, by fermentation. The question, then, arises, are we able by any artificial means of cooking and preparing food, to originate such chemical changes as shall produce lactic or other forms of acid, so as to prepare the way for, and aid, the digestive process in the animal?

This brings us to a remarkable point in the experiments at Woburn recorded by Mr. Lawes. In the sixth of these experiments, when only 5 lbs. per day of cooked oilcake-compound was used, an average gain of 19·4 lbs. of live weight per week was obtained; whereas, in a previous experiment, when 8 lbs. of oilcake was given, the gain over the whole period was 12·3 lbs., and over the last and strictest part of the experiment only 9·2 lbs. Apparently, therefore, the cooked food produced a much more satisfactory result than the uncooked. It ought, however, to be taken into account that the least successful experiment was commenced in October, when the cattle were taken into the yard fresh from ranging the grass, and the more successful one in March, after they had been in the yard some time, and were accustomed to that position and diet. Mr. Lawes states that the amount of manure made in the boxes, with an allowance of about 20 lbs. of litter a day, amounted to a little over 5½ cwt. a week, so as to make 22½ cwt., or rather more than a ton, of manure in a month. Amongst practical men who are feeding animals in boxes, the impression prevails that they are deriving a larger amount of manure than this from feeding their stock, even without more litter than appears to be needful, a good authority estimating it at from 12 to 15 cwt. weekly. Such a wide variation deserves further investigation. In calculating the economical results of the Woburn experiments, it must not be overlooked that the animals were taken from two breeds which are not remunerative as dairy stock. On the Duke of Bedford's estate it is the custom to allow the Hereford calf to run with and to suck its mother; therefore the only profit derived from the cow is that which arises from the rearing of the calf. A price must, therefore, be put upon the young steers much above the common market price of animals of that class, because these are the only returns which the cow makes until she herself is converted into beef. To come to his own experience. Anxious to try the effects of cooking, he last autumn ordered ten beasts to have 2 lbs. of bean-meal boiled and poured over the chaff, which was to stand twenty-four hours; 2 lbs. of cake was then added to the mixture, and it was then served out. Of those ten beasts, however, one obstinately refused to eat the mixture; it was a white bullock with a black nose, and decidedly the worst of the lot. It so stoutly resisted the mixture that it would even eat the straw turned out from the cart-horse stable rather than the prepared food. It was then ordered to have the bean-meal unboiled, but still mixed with straw that had been moistened the day before, and with a small quantity of malt-combs: and at this moment that very animal which had been the worst of the ten was by far the best. It weighed at least 8 stone more than those which were of the same size at Michaelmas, 1 cwt. more in live weight than the smaller animals when they came in, and 56 lbs. more than any other beast in the lot. Professor Voelcker remarks on this:—"The incident you mention with respect to your black-nosed bullock is curious. I don't like to boil bean or pea meal, and to pour it afterwards over roots and chaff. Substances so rich in nitrogenized matters as peas and beans are very apt to give

rise to putrefaction instead of lactic acid fermentation. For the same reason it won't do to mix much cake mucilage with other food, and to let it be a long time. If soon consumed after the addition of the cake jelly, no harm is done; but if left too long after the addition, incipient putrefaction and mould (both of which are highly injurious to the preparation of cattle food) become perceptible in the mess. The tendency to putrefy increases with the amount of nitrogenous matter in the food. When malt-combs are soaked in water, and then mixed with chaff, lactic acid is readily formed, if there is sufficient water present, and the temperature sufficiently high. Sugar in the presence of much water and a sufficient quantity of albuminous matter becomes changed into lactic acid, an acid which has the same percentage composition as milk-sugar itself. Too much or too little albuminous matter is alike unfavourable to the production of lactic acid." He (Mr. Frere) was rather inclined to attribute the more successful feeding of the animal that would not eat the highly nitrogenous warm mess, but was fed on the mixture of malt-combs and straw-chaff moistened with water, to the generation in some degree of lactic acid by that mixture; whereas it would seem, from Professor Voelcker's note, that when the more nitrogenous mixture of boiled bean-meal was poured over the straw, putrefactive fermentation might have begun. The food which he was now giving to his nine beasts was 1lb. of malt-combs apiece, 3 lbs. of linseed cake, 2 lbs. of cotton cake, 3 lbs. of bean-meal, and 2 lbs. of charob or locust beans, with 28 lbs. of mangold and 8 lbs. of straw; and he found that the 9 lbs. of malt-combs took up two gallons of water, and that four gallons of water were taken up by the straw. Therefore the weight of the eight gallons of water employed was greater than that of the straw and malt-combs with which it was mixed. His impression was that there were other means of preparing food, that were more easily available for the farmer, and more economical, than the use of fuel and steam; that there was an analogy between the fermentation that took place in the first act of germination, and the fermentation which it was desirable to produce in this mixed food for the stock, and that malt-combs were a very likely agent to produce that fermentation in the way desired.

The Discussion.

Mr. Lawes said that the experiments at the Duke of Bedford's were not intended to be comparative as between cooked food and dry food. Their object was simply to find out the amount and composition of the dung of box-fed beasts, so as to ascertain more particularly the loss in that valuable element ammonia. The late Duke placed the whole of his establishment at his (Mr. Lawes's) disposal; the experiments made were conducted with extreme care, and the weights of the animals, as far as they went, were extremely correct. He should be sorry, however, if the results of those experiments were taken as a standard in reference to the cooking of food as against the common feeding of animals with dry food;

because the animals which were then fed on dry oilcake did not give the increase they ought to have given. The average increase on that particular set of animals was something like 1 to every 18 parts of dry food consumed, and in other papers he had stated that an increase of 1 from 12 was more like the real average. In such cases conclusions should only be drawn from data of sufficient extent; looking to individual results only leads to error. To draw conclusions in favour of cooking from these experiments alone was, therefore, hardly fair.

In this question there were two points to be considered. The first was, whether the increased labour and fuel expended in the cooking were not equivalent to the saving; and he thought that, taking the gross increase, there was a slight saving. The second was, whether the increase in the animal fed on cooked food was as good as that produced by uncooked food? On this point he was disposed to think that the quality of the meat was inferior when the food was cooked. If pigs were always fed on boiled swedes and meal, although they might increase very fast and be very profitable to the seller, still it would be found out by degrees that the quality of the pork was bad. The butcher would ultimately refuse to buy, and would say that such pork, to use a common expression, "boiled away." All animals as they fattened had a certain amount of water displaced; that was to say, they contained less and less water; but if they were fed with boiled swedes and meal, the water would increase as well as the fat. Some time ago he fed one animal on steeped barley and another on dry barley, with a view of testing the merits of the two systems of feeding. The animal which was fed on the steeped barley increased very fast, while the increase on the other was comparatively slow. They were both killed; the loins and other parts were cooked in the establishment, and it turned out that there was much more waste in the former case than in the latter. The question whether the increase from cooked or from dry food is the most economical, was one of considerable nicety, on which at that moment they had not sufficient facts to guide their opinion; but he should not himself expect to find any great difference in the results. Supposing a man saved 20*l.* a-year by the use of cooked food, and that he spent 10*l.* on labour, and 10*l.* more on coals in consequence, he would in reality be a loser by the cooking, because there would be less manure. Some years ago Mr. Warne's system of cooking was very extensively adopted, but it did not seem to maintain its ground.

But a new phase of the question had been suggested, namely, whether natural cooking or fermenting might not be advantageously substituted for artificial heat. It should, however, be borne in mind that all fermentation meant the loss of a certain quantity of carbon consequent on decomposition. In all food the most valuable constituent was the carbon. If they mixed sugar or saccharine matter with woody fibre, they got a certain amount of heat together which might soften and render the latter more digestible; but that was

always done at the expense of the sugar, which is one of the most valuable articles they had. An animal always eats until he has enough carbon in his stomach; he then stops. He might take double the quantity of albumen, but he would not stop until he had got sufficient soluble carbon, and the soluble carbon was the first thing to disappear in the process of fermentation. He did not think, therefore, that economy of food was to be arrived at by a process of that kind.

Mr. Dent had talked with several gentlemen who had cooked food, and most of them were inclined to give it up; but he had never yet found them disposed to abandon the system of pulping. He had been using malt-combs in the way mentioned by Mr. Frere, and found, in the case of milch cows, that when the supply of combs failed the milk fell off, and when the supply was renewed the milk increased.

Professor Simonds rose simply to answer an inquiry of Mr. Frere's whether the commencement of putrefactive fermentation was likely to interfere with the process of digestion. It was well known, especially in the case of carnivorous animals, that when food which was positively in a state of putrefaction was exposed to the action of the antiseptic properties of gastric juice, the process was arrested, and the food rendered sweet at once. There were proofs of that with regard to the carnivora; and as the gastric juice in herbivorous animals does not differ from that in carnivorous, he supposed that it would act in a similar manner when in contact with food in a state of incipient putrefaction. Such food, therefore, would not be likely to interfere with the process of digestion. His opinion was that, with reference to these matters, we dealt too much with chemistry, and not sufficiently with physiology, or a knowledge of the animal economy.

Mr. Lawes had spoken of the watery flesh of animals fed on cooked food, and there was scarcely any limit to the quantity of water that might enter the animal organism, if we gave food which contained a large quantity of water. Speaking as a pathologist, he believed that a great number of diseases among the lower animals arose from the bad state of blood induced by excess of water, and deficiency of nitrogenized matter in the food. The practical farmer knew that if, in the lambing season, he gave his ewes too many white turnips, or other green food, which had grown rapidly, and contained a large amount of water, it would lead to disease and loss; whereas, if he put them on dry food, containing, weight for weight, a large proportion of nitrogenized matter, a good quality of blood was produced, and the health of the animal preserved. Admitting that cooked food had the effect of accumulating weight, to say nothing about flesh, in a certain space of time, he was inclined to think that this arose from the facility which it gave for the digestion of the food by anticipating a part of the process commonly carried on by the action of the gastric juice.

But it was questionable policy giving to an animal, and espe-

cially a ruminant animal, cooked food, for thus they might to a considerable extent supersede mastication; if so, they would supersede insalivation, and thus interfere with one of the chief processes of nature. The action of the saliva was first to convert the amylaceous parts of the food (or starch) into sugar or gummy matter. A further provision was made in the ruminant animal for stirring up, if he might so express it, the food; and a chemical change took place in its character before it passed into the true digestive stomach. There was a re-mastication and a re-insalivation; and, inasmuch as the secretions coming from the rumen were very analogous to those with which the food were mixed in the mouth, it not only remained mixed with saliva a much longer time, but was mixed with a much greater quantity of that or a like substance. If, then, by the use of cooked food they dispensed with part of the operations of nature, and sent the food quicker into the intestinal canal, they would dispense with the process of re-mastication and re-insalivation; and he could easily understand why, although a large increase might take place in bulk, the quality of the animal might become bad. The digestive process depends materially upon the condition of the food: it is even possible, by giving cooked food, or food which was physically in the same condition with regard to fineness and moisture, to render animals non-ruminative which are naturally ruminative; that is to say, we may give them food that would be retained for a very short space of time in the rumen, pass quickly into the true digestive stomach, and become subject to the action of digestion without first undergoing re-mastication. We should thus interfere at once with the law of nature; if we cook food at all, we ought not, before cooking, to reduce it too fine. If the straw be cut into lengths of from four to six inches, a cooking process may be set up so as to convert the amylaceous parts into sugar, without interfering with the functions of the rumen; but such food would be re-masticated. He would advise that if food is pulped and mixed it should not lie too long to undergo the process of fermentation, but be given pretty soon after it is mixed. Straw might, doubtless, be converted into palatable food, and animals induced to eat a larger quantity of inferior provender cut into chaff, by simply throwing over it a small quantity of oilcake dissolved in water. This was a common practice among farmers in Lincolnshire in feeding their horses, especially during the winter months. Upon the whole, he was certainly not in favour of the so-called system of cooking food, either for the preservation of the health of the animal, or for the promotion of the process of digestion, and was inclined to think that, by the physical alterations they might make in character and condition by the cutting straw, pulping roots, and mixing a solution of oilcake with them, they would gain their point at a lower expenditure, and with much more advantage to the animal economy.

Meeting of Weekly Council, May 21st. Mr. Raymond Barker, Vice-President, in the Chair.

State of Agriculture in Algeria.

Mr. Caird said, the observations which he had to make arose out of a visit which he paid to Algeria, about the beginning of March last, in quest of a new field for the supply of cotton. That was not a topic of any special interest to English agriculturists, and therefore he would not dwell upon it; suffice it to say that great advantages were offered by soil and climate, in some parts of Algeria, for the cultivation of long-staple cotton, a variety which was of limited production in America. The question of cotton cultivation was, in fact, rather a question of the supply of labour than of the particular quality of the soil. There must be labour, water during the period of growth, high temperature, and a suitable soil for the plant to grow in. These elements were presented in the greatest abundance in the Southern States of America, where there was sufficient heat, a soil there peculiarly adapted for the crop, abundant rains during the period when the cotton was maturing, and, under the slave-system, a constant supply of labour available. In all other countries where the cultivation of cotton had been attempted, some one of those necessary elements of success were wanting. In India, for instance, there was no rain during the period of growth, and water must be supplied by irrigation or some artificial means; there was, however, in that country plenty of labour. In the West Indies it was a labour question purely. In Algiers it was a question both of labour and of water; there scarcely any rain falls during the period of growth; irrigation, therefore, is required, and has been already introduced on some of the rich plains, which are well adapted for the purpose.

In all other respects the productions of Algeria are similar to those of many of our own colonies; while that country has the special advantage of close proximity to the chief markets of Europe, being within four or five days' sail of this country, and in the direct track of the Mediterranean trade. Algeria extends about 600 miles along the southern shores of the Mediterranean. The distance from Marseilles to the capital, Algiers, is about 470 miles. The culturable land of Algeria lies between 34° and 37° of latitude, or a few degrees farther north than the lower part of the plain of the Nile, and about the same latitude as Georgia and the Carolinas. This great tract of country was two thousand years ago the granary of Rome; and the traveller still finds everywhere the remains of Roman towns, Roman bridges, Roman aqueducts. Nothing, in fact, is more interesting, in travelling through Algeria, than to find, at every spot where the French Government now proposes raising embankments and constructing canals for irrigation, the remains of similar works, which existed two thousand years ago. He was particularly struck with these ancient remains at a place called Relizan, in the plain of Mina, which since the French occupation had been

found very unhealthy. The French had, owing to the necessities of their position there, drawn their supply of water from a neighbouring and extremely muddy river; whereas there were remains, in excellent preservation, of an aqueduct thirty miles long, which had supplied that town with good water from a great distance, and no doubt materially aided in promoting its prosperity. He need not enter into the history of the changes which had taken place in Algeria from the time of the Roman occupation down to the present day. Suffice it to say, that it was overrun by the Vandals, conquered by the Saracens in the seventh century, afterwards conquered by the Spaniards, and then by the Turks. In 1816 Algiers was bombarded by Lord Exmouth. In 1830 it was captured by the French army, and since that period the country has been gradually reduced under the French rule.

The whole population was about 3,000,000, of which about 250,000 was European. There had been a considerable increase within the last five years—not less than 470,000 in the native, and 33,000 in the European population, indicating a gradual advance in prosperity under French rule. Of the French population a very large portion is military; but it also provides hotel and café-keepers, many excellent farmers, porters, and cabmen, who were extremely civil, but not any great supply of labour to colonists who embarked their capital in the cultivation of the soil. The Spaniards who came over from the neighbouring country comprised a very numerous and excellent class of labourers, cleanly and well dressed, good farmers, road-makers, cabmen, and skilled labourers in an agricultural point of view. Then, on the neighbouring border of Morocco, there were Moroccans, a very fine stalwart race of men, in personal appearance not second to any that he had seen, excellent labourers at hard work, but very deficient in skill. The Arabs, who were the most numerous portion of the population, have the same habits which were ascribed to the old inhabitants by Sallust, in his account of Numidia—modern Algeria—during the time of the Jugurthine war. Sallust describes also the higher soils of the country as healthy, and the lower as the reverse, a description which is still applicable. The higher parts of the country are still healthy; but the plains, which are the richest tracts of country within the borders of Algeria, have been found by Europeans to be generally unhealthy. No doubt drainage, and the extension of agricultural enterprise, would alter that state of things. Already, indeed, in the great plain of Metidja, which lies 50 miles to the south-west of Algiers, a most beneficial change had taken place. Fifteen or twenty years ago that seemed to be the grave of the French colonists; now at different parts there were to be seen thriving and healthy colonies, having luxurious vineyards, orange-groves, and an immense breadth of corn. Although it was not a matter of any practical interest, he might perhaps be allowed to mention that he had received an invitation to dine with an Arab chief in his tent. He was presented, as all strangers were, with goats' milk, and enjoyed the distinction of having a whole sheep roasted for himself

and his party. He might add that the rank of captain was allowed by the French Government to all the Arab chiefs. Besides the Europeans and Arabs, there was a very numerous population of Jews, who had long been settled in the country, having, as it appeared, migrated to it in great numbers after the fall of Jerusalem. The Jews were the bankers and merchants and money-making people of the country.

As regarded the cultivable land, there was a very great tract at a comparatively short distance from the seaboard. The climate was rather monotonous. During twelve years frost had only been found twice in Algiers. The mean temperature was 70° Fahrenheit. The heat increased from January till September; the hottest months being July and August, when the mean temperature was 80°. A very hot wind sometimes set in from the interior, and swept over the whole country. Occasionally it came before the corn harvest, and in that case it proved very destructive. A hot sirocco, loaded with very fine particles of sand, raised the temperature perhaps to 120°, and had almost the effect of an oven upon the ripening corn. It seldom continued for more than four or five days; and if it did not come till after the corn harvest was reaped, did comparatively little injury. In winter the temperature ranged from 55° to 65°. It was during winter and spring that the corn harvest took place. Wheat, barley, and potatoes were all planted in October and November, and reaped in March, April, and the beginning of May. There is a second crop sown immediately after the corn harvest is completed, which is reaped in September and October. This second harvest consisted principally of oilseeds of all descriptions and Indian-corn; but, except where there was an artificial supply of water from springs or wells, the summer cultivation is not successful.

Besides the French colonists, Swiss and Germans are now beginning to spread over the fine corn-growing districts in Constantine. The land is offered to the people of other countries on the same terms as to the people of France, namely, 20*s.* per acre for land suitable for corn-growing. Between Philipville and Constantine there are very fine tracts of land; and that is a very healthy neighbourhood for Europeans.

Altogether, the cultivable land in Algeria amounts to about thirty-four millions of acres, which is more than the cultivable extent of England proper. Of these thirty-four millions, five millions are cultivated—ten in pasture, twelve waste, and four forest. The extent of land in corn, in 1861, was 4,500,000 acres, 2,000,000 of which were barley—an immense breadth, as is evident from the fact, that only about one million acres annually are under barley in this country. Vegetables of all kinds are here grown in great abundance, and a considerable trade has already sprung up in the supply of vegetables to the French and English markets.

Since 1850 an enormous increase has taken place in the exports: that of hides is very considerable. Of wool, which was one of the great industries of the kingdom, the export last year amounted in

value to upwards of 6,500,000 francs. Olive-oil was also a large item; so also was an article called vegetable hair, which was got from the dwarf-palm, and was used for stuffing beds and couches. The export of the latter article rose in value from 20,000 francs in 1850 to 1,500,000 francs in 1860. Up to 1844 there was no export of tobacco; in 1860 it reached the value of 5,500,000 francs. He might remark that there were about 13,500 acres under cultivation as vineyards, producing in value 2,000,000 francs a-year.

It is calculated that there are about 1,000,000 cattle in Algeria, and 10,000,000 sheep. The French Government considered Algeria to be the Australia of France, as regarded sheep-farming. He there found three European shepherds managing about 1400 sheep; and, according to the accounts given to him by the proprietor, the sheep were extremely healthy. The ewes on an average gave an increase of one lamb per ewe. The sheep were never supplied with artificial food; and the only thing that was at all special in their management was that they had to be housed during very hot weather.

The French had constructed large lines of road in all the principal portions of the country, and they had commenced a very extensive system of railway communication, which would traverse all the richest plains, and afford easy access to all the most important points.

He would now ask them to follow him in the route which he took after landing in Algeria; and while they did so, it would be his effort to bring before them those points which were most interesting to the practical farmer. On landing at Oran he found in the vicinity of that town a strong red fertile soil, and a country undulating to a height of from 200 to 300 feet above the sea. Having just travelled through Provence, he was enabled to state, by way of comparison, that the soil of Oran very much resembled the rich red soil of Provence. There were large fields of wheat, barley, potatoes, vineyards, olives, oranges, and figs; and he found that the price of the land, when cleared of all the dwarf-palms which covered all waste lands, was about 3*l.* per acre. From Oran he proceeded across the country to the Bay of Arzew, where, on visiting a French settlement called the Sig, he found that a great advance had been made in agriculture. He met with several most intelligent Frenchmen, who had embarked in the purchase and cultivation of the soil, and they all seemed quite confident of success. They had immense fields of corn, and had also begun to plant vineyards, and the cotton cultivation was proceeding very favourably. He then went to Mostaganem, a town of about 20,000 inhabitants, very beautifully situated, and overlooking the sea. The land in the neighbourhood appeared very fertile.

While there he visited one of those establishments which the French Government had set up for the improvement of the breed of horses all over the country. Great attention is paid to this object, and not only the best stallions, but also the best mares, are obtained from Syria, and sent to various settlements. Their object in this was not merely to improve the breed of horses

among the Arabs, but also to enable themselves to mount the French cavalry with Arab horses of the best description. For that purpose, as much as from 80*l.* to 100*l.* each is paid for mares, and from 30*l.* to 40*l.* for stallions. Many of the French cavalry regiments even in France are now being mounted with horses of Arab blood, which are found very hardy and serviceable.

The soil in the neighbourhood of Mostaganem was a dark red soil of excellent quality. Fig-trees were numerous; and the whole district was admirably suited for the growth of sugar-beet. He there met with a very intelligent Jersey farmer called "Jemmy Brown," who had been settled in Algeria about twenty years, and cultivated about 60 acres of very productive land. His corn crops failed from drought once in five years, but never failed when they were irrigated. There were no taxes on the land, or on any kind of produce except tobacco, which was in fact a Government monopoly. The climate and soil were the best in the world for vines, figs, almonds, and olives; the mulberry did well, but labour was not plentiful enough for it. This small farm was cultivated like a garden. The soil was a deep, light, sandy loam. Water was applied to it regularly, and vegetables chiefly were grown upon it for market. This Jerseyman had made a well, 24 feet deep, at a cost of 140*l.*, which, with one horse, enabled him to water the whole of his farm, the work being performed at the rate of 7 or 8 acres per day. He grew two crops of potatoes a year, which were ripe in six weeks after coming up; and he cut oats and barley three times for forage. His meadow was most extraordinary: it consisted of lucerne, and was watered every six days, and cut ten times a year; and it continued in the ground ten years (what he saw, had been there six years). It was ready in twenty days; and a space of 19 yards square kept two horses the whole year. The vineyard needed no water. It cost 5*l.* an acre to prepare and plant, paid its expenses in the second year, and yielded a profit in the third year: 8*l.* per acre was obtained for an outlay of 32*s.*

He also visited a French farmer, the Viscount d'Armagnac, an old French general, who was settled on the plain of Mina. The wines there produced seemed to him just like the red wines of Provence, and the French regard Algeria as a wine country of great promise. Objections were at one time offered to the cultivation of the vine in Algeria by the vine-growers of the south of France; but these had now been done away, and it was anticipated that the vineyards would rapidly increase. General d'Armagnac had about 2000 acres of land, all of good quality. He sowed his wheat and barley in October, and reaped in April. The corn crops were followed by an oil crop called "sesame." This plant produced an oil similar to olive-oil, but much purer. When grown in India it cannot be imported in perfection because the oil turns rancid in its passage through hot climates; hence a greater value is attached to the growth of sesame in Algeria, whence it could be sent in perfection to France or any other European country. The Viscount grew it to a considerable extent, and found

it very profitable. He also found castor-oil extremely profitable, but did not grow it largely. The sugar-cane had been tried successfully as an experiment; and a person who had grown it in the south of Spain with success said that it yielded more on the plain of Mina than in Spain. The General was paying 12*s.* per acre for the use of water, which he had found indispensable to the summer crops. His wheat looked splendid; his barley on the 14th of March was in full ear. He had been fifteen years in Egypt, where he said the plain of the Nile very much resembled the plain of Mina, except that the annual deposit of the Nile made the land there lighter.

From Helizan, on the Mina, he (Mr. Caird) was travelling for nearly two days up the plain of the Shelliff, which was the principal river of Algeria, and ran through a very large extent of country. The soil was a deep loam all the way, and owing to heavy rains had become so sticky that it was almost impassable. There was not a single farm or settlement until he reached the base of the mountain on which stood Milianah, where he found some Arab culture, but no regular farming. The whole plain was very fertile. It was bounded on either side by mountains from 2000 to 4000 feet high. On the south was seen the distant range of the Atlas, the loftiest part of which was 7000 feet high, and there the snow was lying in patches. Milianah is situated about 2000 feet above the plain, on a bluff half-way up the mountain. There was an ascent of several miles, with gardens and streams continually in view. Nothing could be more beautiful than the position of the town. In olden times it was a Roman settlement; in our own times it was the capital of Abd-el-Kader, and the French had great difficulty in obtaining possession of it. From Milianah there was a splendid road—as good a one as any to be found in England. For three hours' driving there was a continual descent, and then he arrived at the edge of the plain of Metidja, in sight of the sea. The first place he came to was Bourkeka, at the western end of the plain. It was first colonised as a convict settlement; but the convicts all died. At the time of the French Revolution, in 1848, it became a settlement of Parisian workmen, who almost all died from fever, or in consequence of their incapacity for the peculiar kind of work required. There had been no less than three populations in twenty years. In passing along he was struck with a very singular contrast between the industry of the native Arabs and that of the French population. There were a number of French and Arab carriers; and while the former had each five mules in a high-wheeled, large, and strong cart, carrying not less probably than four tons, the latter had a donkey with half a cwt. of vegetables. That seemed to him a striking illustration of the advantage of civilisation as regarded the economy of labour. The plain of Metidja is one of the largest in Algeria: it is 50 miles long and 12 broad, comprising 500,000 acres, and stretches to within a few miles of Algiers. The soil at the western end is black, like that of the prairies. At El Affrond, a very thriving settlement, it is redder, and is planted with vines and mulberries, as well as corn. At Blidah he observed immense plantations of oranges, corn, &c. Thence he proceeded to Algiers,

which contained a population of about 100,000, and was now a complete French town. It was beautifully situated, and is the resort of many English and Scotch families, being recommended as a winter residence in cases of pulmonary disease.

The French had been greatly blamed for their policy and management of Algeria. It should, however, be remembered that Algeria is not merely a colony, but a conquered country. Little more than ten years have elapsed since it was subdued; and within that period roads and bridges have been constructed, harbours been improved, towns been built, and railways commenced. The French Government naturally believes that Algiers will prove the granary of France, as in former times it was of Rome. It is remarkable that seasons which are unsuitable for the production of large crops in France are favourable in Algeria—that is, very wet years. Algeria is a very fine wool country; and it was more easy for the French Government to improve the growth of wool—a branch of industry which was already established — than to develop the growth of cotton, which was as yet a comparatively new branch. The sheep were generally of native races, but some were crossed with European blood.

In 1841 Abd-el-Kader boasted that the French occupied only the soil which they covered with their feet; now the traveller was considered quite as safe in any of the cultivated parts of the country of Algeria as he would be in France or England. The Government now gives every encouragement to individual enterprise. They were adopting as far as possible the system which prevailed in this country, of leaving individuals to carry out their enterprises unfettered by needless regulations on the part of the state. Their new system of laws with regard to the sale and transfer of land, no doubt, would be productive of great advantage both to the emigrant and the native population. The revenue of the country was already 6,000,000 francs more than its expenditure, exclusive of the cost of the army, which is an imperial affair. The people of the country, formerly subject to the Turks, had changed only their rulers. Previous to 1830 the whole value of the export trade under Mahomedan rule was but 7,315,000 francs; under French rule it was now 166,000,000 francs. So vast an increase must have been beneficial to every one. With civilisation progressing rapidly, and every advantage offered for the development of a great country, it must be gratifying to them to know that not less than 600 miles of the southern shore of the Mediterranean had been rescued from the rule of barbarism, and was now placed within the reach of the enterprise of every man of any country who was willing to avail himself of its advantages.

THE DISCUSSION.

The CHAIRMAN expressed his thanks to Mr. Caird for introducing the subject, and inquired whether the meeting was to understand that every part of the country was now subjected to the French dominion?

Mr. CAIRD said, it was all under French rule; but there were

some parts of which some of the tribes claimed ownership, which claim would, no doubt, be recognised by the French Government. There was no finer part of the country than that which extended from Philipville to Constantine, and it appeared to be very suitable for European emigrants.

Supply of Labour.

Mr. Frere said that, when residing in Algeria for some time in 1855, he had received a less favourable impression as to the supply of labour than that which Mr. Caird appeared to have received at a later date. There were at that period few French agricultural labourers. The Spaniards were in part the offscourings of the Spanish Peninsula, and the Maltese were but little better; while the Arabs proper considered it beneath the dignity of their race to till the soil. The only race of labourers at all to be relied upon were the native Berbers, or Kabyles, who were conquered by the Arabs.

Mr. Caird stated in reply, that the people whom the French Government had the greatest difficulty in subduing were the people of Kabylia, who occupied a tract of country lying near the sea, had a fixity of tenure, and were many of them persons of considerable property; and it was a remarkable fact that, since they were subdued, the Kabyles had been the most peaceable and thriving portion of the whole population of Algeria. They furnished labour not only for their own district, but for other parts of the country as well.

Breeding Horses.

Mr. Frere said, with regard to the breeding of horses, national establishments do not practically afford as great advantages as might at first be supposed, the spur of personal interest being wanted for their due regulation. On visiting an establishment of that kind in Algeria, he saw a very fine stallion, which had such a vicious temper that none of the grooms durst approach him till he was nearly exhausted. In his opinion it was quite as important to attend to the temper and disposition of a sire as to his form.

Liebig's Mineral Theory.

Mr. Frere also called attention to the statement of Baron Liebig, that those countries which had formed the granaries of ancient Rome had fallen into decay in consequence of the soil having been exhausted of its mineral matter; and inquired whether the present state of Algeria supported that view. If Liebig's views were correct, the application of phosphates, lime, and even potash, would be beneficial to the modern crops in such countries as Algeria.

Mr. Caird said in reply, that the crops of Algeria certainly exhibited no symptoms of exhaustion; and he should be inclined to say that a rest of nearly 2000 years must have had the effect of restoring to the soil qualities in which it had become deficient. The only use to which he saw dung applied in Algeria was that of making embankments for the purpose of irrigation. He might add that the great valley of the North of Italy, which was just as much a granary of ancient Rome as Algeria, was as fertile now as it had been in the days of Julius Cæsar.

Meeting of Weekly Council, May 28th. Lord WALSINGHAM, Vice-President, in the Chair.

LECTURE ON TOWN SEWAGE.

Dr. VOELCKER said: It has been calculated that nearly 200,000,000 tons of liquid pass annually through the London sewers, containing an enormous quantity of excrementitious matters, of which the substances have been very carefully calculated both for the London sewers and also for other towns. I desire especially to refer to the excellent paper published some time ago by Mr. Lawes in the 'Society of Arts Journal,' which seems to me very conclusive. Mr. Lawes states, that the total amount of such matter, when deprived entirely of water, comes to 46 lbs. per head per annum, in which there are 35 lbs. of organic, and 11 lbs. of mineral substances. The principal, if not the sole, valuable fertilising matter in the organic substance is the nitrogen, which is found, partly as ammonia, or ammoniacal salts (chiefly carbonate of ammonia), and partly, to a minor extent, in the shape of organic matter in a state of incipient decomposition, in which state it readily contributes to fertility. The most valuable part of the mineral matter in the ashes is phosphoric acid, phosphate of lime, and potash, which enter into the composition of the urine. The nitrogen is by far the most valuable element of sewage. Mr. Lawes calculates the total quantity of nitrogen in the London sewage at 8859¾ tons, which corresponds to 10,758¼ tons of ammonia; and the total amount of excrementitious matter, when perfectly dried, at 51,286¾ tons. We can thus arrive pretty well at a theoretical notion of the value of the sewage both of London and of other towns, and likewise of the average composition of sewage.

But the actual analyses of samples, taken at various times, perhaps afford us a still better criterion. Many of these have been published in Dr. Hoffman and Mr. Witt's report to the government; others in Mr. Mechi's pamphlet on the sewage of towns, as it affects British agriculture; the most recent analyses of London sewage, perhaps, are those which have been made by Dr. Letheby for the City of London. Taking the average of Dr. Letheby's analyses, I find that the total amount of solid matter in sewage taken from various main sewers comes to 94 grains per gallon during the day-time, and 79 grains during the night; giving an average for the whole day and night of 86 grains. But on putting together 24 of the analyses—25 were made altogether, but I reject one, because it contained an enormously large quantity of solid matter—taking 24 normal analyses of Dr. Letheby, and grouping them into two classes, the one showing less and the other more than 86 grains, I find in the former class 15 analyses furnishing on an average only 66 grains of solid matter in the imperial gallon, and in the other nine samples yielding on an average 123 grains. Now, considering that this occasional excess of solid matter takes place especially on rainy days, and is due mainly to the washings of the streets, and therefore principally

consists of useless earthy and organic sweepings, I think we obtain a wrong idea of the concentration of the sewage by striking an average in which we incorporate all the analyses made throughout a certain period of the year. If we rejected the abnormal results, we should arrive at a better idea of the average quantity of solid *fertilising* matter, which is our chief object. We should then find that the average proportion of solid matter, which is given by Dr. Hoffman and Mr. Witt as high as 102 grains in the imperial gallon, is too high, and that 70 grains per gallon, or one part in a thousand, is a fairer estimate than even the 86 grains, Dr. Letheby's average result.

This quantity agrees remarkably well with observations that have been made in other localities. Thus, in the sewage of Birmingham I find an average of nearly 70 grains; sometimes a little less, sometimes a little more. We must naturally expect such variations. Dr. Wrightson also found there about 70 grains; and in the sewage of other towns the average of solid matter is seldom much higher than 80 or 90 grains. Even in the most concentrated sewage of Birmingham the amount of solid matter is, as I know, seldom higher than 105 grains. On the whole, then, I believe we are not far wrong in stating that town sewage contains on an average one part of solid matter in a thousand.

Let us inquire, in the next place, into the character of the solid matter. Messrs. Hoffman and Witt estimated that the 102 grains which, according to them, are found in the imperial gallon, consist of—nitrogen 6·7; phosphoric acid, 1·8; potash, 1; organic matter, 30·7; or a total quantity of 40·2 grains of fertilising matter—the remaining 62 grains being worthless. Supposing a gallon of London sewage to contain 90 grains of solid matter—an over-estimate, which I take that I may be certain of dealing fairly with sewage—the following Table will fairly represent its composition:—

Average Composition of London Sewage.

	1 Gallon contains	1 Ton contains		1 Ton of the Dry Constituents of Sewage contains	
	Grains.	lbs. ozs.	lbs.	lbs.	lbs.
Organic matter and salts of ammonia ..	30		1		747
Yielding ammonia .. .. 7 grains	..	0 3½		163¼	
Mineral matter	60		2		1493
Containing—					
Phosphoric acid .. 1 grain	..	0 0½		23	
Potash .. .. .. 3 grains	..	0 1½		69	
Worthless matters .. 56 grains	..	1 14		140	
Total amount of constituents ..	90		3		2240

I find then, in these 90 grains, 30 of organic matter (including 7 grains of ammonia) and 60 of mineral matter, and that in this mineral matter the valuable portion, the phosphoric acid, amounts

to 1 grain, and the potash to, at the maximum, 3 grains. In a ton of sewage we have $3\frac{1}{7}$ lbs. of salts of ammonia, 2 of mineral matter, and in this mineral matter half an ounce of phosphoric acid, $1\frac{1}{2}$ of potash, and nearly 2 lbs. of worthless matter. A ton of the dry constituents of sewage contains $163\frac{1}{4}$ lbs. of ammonia, 23 lbs. of phosphoric acid, 69 lbs. of potash, and nearly two-thirds of it is worthless matter. So that, even if we evaporate sewage into a state of dryness, we should still have in the solid matter a very considerable portion of useless material. This point deserves special attention, for in valuations of the sewage of towns it is always compared with Peruvian guano. Now, if we leave the water out of consideration, it is hardly fair to compare the dry matter of the sewage with a material like guano, which hardly contains any valueless substance.

Let us now examine the value put upon sewage by various chemists. Professor Hoffman calculates that a ton of sewage is worth on an average about 2*d*., or 17*s*. 7*d*. per 100 tons. Accordingly the whole sewage of London would be worth 3796*l*. per diem, or the enormous sum of 1,385,540*l*. per annum. Guano at 11*l*. per ton is the standard on which these calculations are based. It is calculated how much ammonia occurs in the solid matter of sewage, and this is valued at 56*l*. a ton. The amount of phosphate of lime is calculated at 7*l*. a ton, and the potash at 31*l*. a ton; the result being that the total solid residue from sewage is thus valued, in round numbers, at 6*l*. per ton. Now, following the same track which other chemists have trodden, I find that, by taking the average composition which I here assume, the *solid matter* in London sewage would be worth about 5*l*. 2*s*. 4*d*. a ton. In this estimate I take ammonia at 6*d*. a lb., potash at 3*d*. a lb., and phosphoric acid at 2*d*. a lb. According to this estimate a ton of sewage would be worth not quite $1\frac{3}{4}$*d*.

These theoretical calculations, however, are altogether fallacious; for, in calculating the value of a manure, we must not merely estimate the amount of fertilising matter which it contains, but must consider its bulk and combination. The calculations on which comparisons are drawn between guano and sewage start on wrong premises. In guano we have a portable manure which we can supply when and where we want it, so as to supply an abundance of food to certain crops like our root crops at a critical stage of their existence. The same quantity of guano or superphosphate mixed up with a large body of soil—say 18 inches deep—would have been of little service for such an object. When once the roots are fairly established, with their various fibres drawing nourishment from the soil, and their leaves spread to the sun and air, and thus the apparatus for taking in food on all sides is formed, the natural sources of supply are amply sufficient to provide for their luxuriant growth. We cannot, in fact, materially alter the composition of our soils, taking the whole bulk of the soil into consideration, by any amount of manure. Nor can we, chemically speaking, deteriorate the land by the most exhaustive crops, if we regard the soil as a whole. In reality we manure only

a small portion of the soil; and in ordinary good farm practice, we endeavour to keep the manure, be it natural or artificial, as near to the surface as possible. The value of a manure, then, depends quite as much on the facility with which it can be applied, as upon the amount of the fertilising materials which it contains. Concentrated manures, such as superphosphate of lime or guano, are, for this reason, of the greatest utility on most soils; for most soils are rich in plant food, but they do not contain sufficient to meet the requirements of the plant in its early stages of growth. Our ordinary farm routine is to manure principally a small portion of the soil, just to provide for this requirement.

On a sandy soil, it is true, we must put in everything that is to go afterwards into the plant; and it is on such soils that sewage may be used with very great advantage, and that bulky manures, like farmyard manures, will always be applied with as great, or even greater advantage than most artificial manures.

But on most other soils, and more especially those which contain a sufficient amount of clay, we have both a great abundance of minerals and also a considerable amount of matter capable of yielding ammonia in decomposition, as the following analyses show :—

Analyses of Three Clay Soils.

	I.	II.	III.
Water driven off at 212° F.	5·53	..	..
Organic matter and water of combination ..	3·62	5·38	6·11
Oxides of iron	3·07	6·82	8·34
Oxides of alumina		6·67	
Carbonate of lime	·74	..	..
Lime	..	1·44	·41
Magnesia	·60	·92	1·49
Potash	·26	1·48	·65
Soda	·22	1·08	
Phosphoric acid	·38	·51	..
Soluble silica	1·45	72·83	·04
Insoluble silicates (fine clay)	84·10		80·69
Chlorine and sulphuric acid	traces	traces	traces
Carbonic acid and loss	·03	2·87	2·27
	100·00	100·00	100·00

Moreover, clay itself possesses in a high degree the power of absorbing ammonia from the atmosphere. Still, however valuable may be the stores of food for plants which those soils contain, they do not appear to have enough in an available form for the young plant. We therefore apply a concentrated manure just to start the plant, and when this is accomplished, the manure has fulfilled its purpose, though it cannot add much to the general fertility of the land.

The maximum effect which such concentrated manure is capable of producing on a soil is soon reached. 3 cwt. of superphosphate of lime is found to answer quite as well as 6, 7, or 8 cwt. per acre.

The value, then, both of guano and superphosphate depends on their concentrated form.

If sewage had been compared with bulky farm-yard manure, instead of with guano, very different would have been the results. To illustrate this, let me point out the composition of fresh and of rotten farm-yard manure. Without entering into minutiæ, I may state that a ton of rotten dung contains 8½ lbs. of soluble phosphate of lime. This, at the usual price taken by chemists, is worth 2*s.* Then it contains 10 lbs. of potash, worth 2*s.* 6*d.*; 16 lbs. of ammonia, worth 8*s.*; and 12½ lbs. of insoluble phosphate, worth 1*s.*; thus we arrive at 13*s.* 6*d.* as the *calculated* value of a ton of farm-yard manure. I need not say that this calculated value is far above that which we actually pay. 3*s.* per ton, or at the most 5*s.* per ton, is, I believe, the price generally given for farm-yard manure. Making the same calculations for fresh farm-yard manure, I find the following result. We have 6½ lbs. of soluble phosphate of lime, worth 1*s.* 8*d.*; 8½ lbs. of insoluble phosphate of lime, 8½*d.*; 12½ lbs. of potash, 3*s.* 1½*d.*; and 15 lbs. of ammonia, 7*s.* 6*d.*; or a total of 13*s.* We thus get a value for rotten manure of 6*d.* less per ton than for fresh; and in both cases assume the value of farm-yard manure to be two or three times as high as it is in reality. Now, in dealing with a manure still more bulky, still less under our control than farm-yard manure, I cannot see why we are not to take into consideration that its value in a great measure depends on its being manageable.

Sewage manure, then, is only valuable in special cases, such as that of land that has in itself little or no fertilising matter, but is porous, and allows certain crops to penetrate deep in search of food —that is to say, a sandy soil, such as those analysed in the following Table:—

ANALYSES OF FOUR SANDY SOILS.

	I.	II.	III.	IV.
Silica and quartz sand	96·000	92·014	90·221	94·70
Alumina	·500	2·652	2·106	1·60
Oxides of iron	2·000	3·192	3·951	2·00
Oxide of manganese	trace	·480	·960	..
Lime	·001	·243	·539	1·10
Magnesia	trace	·700	·730	trace
Potash	,,	·125	·066	·10
Soda	,,	·026	·010	
Phosphoric acid	,,	·078	·367	trace
Sulphuric acid	,,	trace	trace	,,
Chlorine	..	,,	·01	..
Organic matter (humus)	1·499	·490	1·04	·50
	100·000	100·000	100·000	100·00

You will notice that the preponderating element in these sandy soils is silica. In some of them there is hardly any potash and phosphoric acid, and in two only a small quantity of phosphoric acid. These soils, then, are greatly deficient in every description of food.

Hence, if we want to get any crop at all, we must apply a bulky manure and an abundant supply of food. Now sewage is well calculated to furnish this food, provided we apply it largely, and not, as has been proposed, in quantities amounting to 3000 or 4000 tons per acre. Those who recommend such a small quantity forget that in 300 tons of London sewage we have in reality not more than the fæces of five persons—a supply for which it never can be worth while to lay down pipes or to make any provision whatever. I hold with the most ardent advocate of the use of sewage, that it is a pity that a liquid which contains an enormous quantity of fertilising matter, and which may be used with very great advantage on sandy soils, should be let run to waste. Yet, if we wish to derive any material benefit from it, we must use it largely—that is to say, as ordinary water is used for irrigation, in quantities amounting to from 8000 to 10,000 tons per acre, in, say, five dressings, averaging 1400 tons apiece. But even then it will not benefit every description of crop, but, as has been proposed, may well be restricted to Italian ryegrass and other grass-crops.

Grass is especially benefited by the sewage of towns, because it is a quick-growing crop, which allows us to apply a fresh fertilising matter as soon as a given quantity is exhausted. Grass-land may be manured repeatedly, but not so the cereal crops. Our wheat would never ripen if, after it has passed through its grassy stage and approached maturity, we were to apply sewage to it: the grain would never get formed. Neither is sewage generally applicable to market produce; it has a tendency to encrust the soil and to close up its pores, which is a great practical inconvenience. But apart from this objection, I question whether we could dispose of the sewage of a large town in market gardens, because it must be dealt with at all times of the year, and in very large quantities.

With regard to the grass grown by the application of sewage, it is stated in many treatises that the produce from irrigated meadows, more especially meadows irrigated by sewage manure, is superior, inasmuch as it is richer in nitrogenous matter than ordinary farm produce; but I believe that this is a mistake, and that in nutritive quality the grass from the irrigated meadow will be found inferior to that from natural pastures, the produce of meadows irrigated by sewage being in a still higher degree inferior. In fact, the more rapidly produce is grown the less mature it is, and the more likely to produce disorders in the animal economy; whilst, bulk for bulk, the poorer the meadow the more scanty the herbage, and the more slowly it grows, the better and more nutritious it is. Of course it does not follow that we should leave off manuring our fields and grow a scanty increase for fear of inferior produce.

Notwithstanding all these drawbacks, however, great sums have been realised by the application of large quantities of sewage to meadow land. And, after all, the most satisfactory way of arriving at a fair and just estimate of the value of sewage is to inquire of

men who have tried it on a pretty extensive scale. We learn from farmers residing in the neighbourhood of Edinburgh that they can realise by the application of sewage from 25*l.* to 40*l.* per acre—the average perhaps is about 25*l.* per acre. But if we calculate the value of the dressings applied, as has been done by Dr. Hoffman and other chemists, and, *for illustration' sake*, by me to-day, we shall find that the calculated value of the fertilising constituents comes to something like 75*l.* or 80*l.*, whilst the profit realised is only 25*l.*; which shows plainly the exaggerated nature of these calculations. If we look rather to the produce than to the price set upon the constituents of sewage, it will be found that its fertilising value is on an average perhaps one halfpenny a ton.

Moreover we learn from the practical experience of men who apply the sewage under the most favourable circumstances that the produce rises just in proportion to the quantity applied. To get a material advantage from the application of sewage it should go through the soil. Those soils will be most benefited by its use which act merely as the vehicles for holding the manure. We must never think of storing up the liquid manure in the soil. The soil does not hold such fertilising matters.

A great deal has been said of the powers of soils to absorb manuring matters; and it is true that all soils, not even the most sandy soils excepted, have the power of rendering insoluble to a great extent the soluble fertilising matters that we usually find in manures; but they have not the power of rendering them *completely* insoluble, and from very dilute liquids they take away very little indeed. If time permitted, I could refer you to some experiments which I have made with a view of ascertaining whether soils have the power of retaining soluble matters to any extent; but it may suffice to state in a general way that the weaker the solution the less is the soil capable of retaining the soluble matter. Thus, in operating with very dilute solution of ammonia, I find that hardly any ammonia is retained by the soil; and again, that the proportion of phosphoric acid which is left in the liquid after passing through the soil is just as large as it was before it was applied.

By filtering very dilute liquids, such as sewage, through soils which, like clay soils, contain potash, you may even take out the potash. This was the case with an experiment which I made on Mr. Mechi's soil. By filtering some of his tank liquid through his clay land I actually obtained more potash in the liquid that filtered through the soil than was contained in the tank liquid itself; thus showing plainly that the fertilising matters from very dilute liquids are not retained in the soil; and that we must not, therefore, calculate upon storing in the land during winter the fertilising matters of sewage. If we are to derive benefit from the practical application of the sewage of towns, we must apply it in large quantities, and get an immediate return in the course of four, five, or six weeks. Then we may give a new dose of manure with advantage, and so on. But with so dilute a liquid, which absolutely contains a considerable amount of fertilising mat-

ter, but relatively a small quantity, we can follow this procedure to advantage only with grass-crops.

It may be said that liquid manure has also been used with advantage on clay soils. To this I would reply that on clay soils, when well drained, pure water has been likewise used with very great advantage; and that by irrigating clay soil with the purest water, even distilled water, we should probably obtain a very high produce. Indeed, experience shows that in our neighbourhood, where clay soils,—well-drained clay soils, abound, the spring produce is almost entirely regulated by the amount of rain that falls. A showery spring gives us more grass than any description of manure, be it natural or artificial, that we can put upon the land. When, therefore, sewage produces on clay soils a highly beneficial effect, I think it is principally in virtue of the amount of water which it supplies.

Mr. Mechi made a true observation when he said that in all calculations the water has been neglected. In many cases it is a most valuable constituent. In the case of clay soils which contain an abundance of fertilising materials, the water, when put on in large quantities, so as to soak completely a large mass of soil, renders these materials soluble, and by degrees they are brought within reach of the growing plant. Thus it is that water, pure water, on clay soils produces in many cases enormously large results. In such cases the quantity of matter which we put on in sewage is too small to have any practical bearing on the result. Whilst, then, on clay soils water is the most valuable constituent of sewage, it is also of great utility on sandy soils, although, when we must furnish to the soil all the plant food required to produce a crop, even the fertilisers contained in sewage assume a very high importance. There are various other topics on which I must not touch, after having already detained you so long, but I trust that on several points which I have brought forward to-day I may have removed some misconceptions affecting that important question, the proper application of town sewage.

The Discussion.

Sir John Johnstone, M.P., observed that he, with some other gentlemen, had superintended a large lunatic asylum in the neighbourhood of York, and had endeavoured to utilise its sewage in various ways. Not having grass-land sufficient to take it all, they had poured a part over the garden ground cultivated by the patients, in the hope that what was valuable in it might remain in the soil. It was so applied during the winter, and the governor of the institution fancied he saw good results in the crops of roots, cabbages, and other market-garden produce; but after what the learned professor had stated to-day it seemed to be doubtful whether it might not as well be let run into the river. The soil was diluvial, and of a rather porous sandy nature.

Mr. Frere said Dr. Voelcker had showed that the value of a fertiliser might be estimated by the crop that it enabled us to grow off the soil. Now it must be borne in mind that certain fertilisers

were of the nature of stimulants; so far, therefore, as their virtue was a stimulating virtue, which induced the soil to part with more of its plant-food than it would otherwise do, so far it would leave the field in a poorer condition than it found it. So that some charge must be made against the crop for impoverishing the field. No doubt, *if* we are justified in believing that the soil of a field has a standard fertility which could be but little changed either by the application of manure or by exhausting crops, so far the deteriorating influence of stimulating manures might be overlooked.

Mr. Blackburn said, as to the difference in value of different crops of grass, he had believed that plants, including grass, which grew quickest, contained the largest amount of sugar and starchy matter, and that, from slowness of growth, the sugar and starchy matters became converted into woody fibre. He found, for example, that the quicker his garden crops, celery and other vegetables, grew, the better was their quality. He believed that Professor Way supported that view.

Dr. Voelcker said, it was at one time generally believed that the amount of nitrogenous matter was the measure of the nutritive quality of the produce, and Professor Way, with other chemists, having found in the grass and hay of irrigated meadows more nitrogenous matter than in ordinary produce, arrived at the conclusion that it was really more nutritious. But now the tide has set in a different and more reasonable direction—a direction that is borne out by practical experience. Now an excessive quantity of nitrogen in produce is regarded rather as an indication of unripeness, of which one defect is a deficiency of sugar. If in young produce there is not so much woody fibre as in old, there is not so much sugar. If the produce be allowed to get over-ripe the sugar becomes converted into cellular fibre; but to a certain extent both went on being formed together. In young celery there is one thing in much larger quantity than in old, that is water. Indeed, in all forced produce, the quicker the growth the more water you have. The crisp condition of celery is in a great measure due to the large proportion of water present, which comes to 93 or 94 per cent.

In reply to an inquiry by Mr. Raymond Barker, Dr. Voelcker said that hay could not be made on irrigated meadows at all. He had stated that irrigated meadow-land did not yield so nutritious a produce as natural pastures; he might go further and affirm generally of all kinds of produce, that just in whatever degree an abundance of manure was applied and larger crops were obtained, in that degree would the quality of the crops be inferior. The rule holds good for wheat and barley, and even turnips. If you want something good, you must be content with a small quantity; if you want much, you must take it in a cruder state. If you want a good leg of mutton, for example, you must be content with a small one, and kill a Southdown sheep; if you want a large one, you will kill a Cotswold, and get coarser meat.

Meeting of Weekly Council, June 18th. The Earl of Powis in the Chair.

The subject of improved farm buildings was brought under notice by Mr. John Elliot, of Southampton; and Mr. Blundell, of Bursledon, near the same place. The latter gentleman also introduced the question of the most profitable method of fatting bullocks on arable farms.

Farm Buildings.

Mr. Elliot said, the chief objects to be borne in view in the erection of farm buildings were economy in construction, with durability; convenience in arrangement for inspection and supply of food and attendance with the least amount of labour; production and preservation of manure; comfort to the animals, with facilities for ensuring pure air and water, light and warmth. It must be conceded that the vast majority of existing homesteads did not fulfil these conditions. One fixed idea seemed to have taken possession of the minds of their builders—that of placing the building on the sides of an open square yard, in which was placed the straw intended for conversion into manure, to have much of its valuable matter washed out by the rain, and more also carried off by sun and air. Where manure was of little value, time of small account, and inspection of no moment, the arrangements of the old homesteads might be put up with; but they were clearly out of place wherever farming was carried on scientifically, and wherever the great truth was recognised, that its profits mainly depended on small economies throughout. When the Five-Thousand were fed with the five barley-loaves and three small fishes, the Author of the miracle closed it with the command, "Gather up the fragments, that nothing be lost;" and the comment was as important as the fact it illustrated.

The selection of a site would be the first consideration for the builder of a homestead. Lord Bacon says, "He who builds a farm-house on an ill site committeth himself to prison." A wrong selection was clearly an irremediable evil, and the choice of site, therefore, deserved the deepest consideration. The first point will be the healthiness of the locality, and its capability for drainage. Marshy or boggy ground, or the vicinity of stagnant waters—anything, in short, to cause damp heat, or moist cold—must be carefully avoided, and a sluggish atmosphere equally so. The stiffest breeze brought health; but stagnation in air, land, or water implied loss in health and profit. If a hill-side could be secured sloping gently to the south, it would be an advantage; but this point must give way to others of more moment. The relative position of the various descriptions of land, the direction of the market town, the roads and their inclination, had all to be taken into account. It by no means followed that the centre of a farm would be the best site either as to draught or distance. For instance, sheep-lands received little from the steading, and the sheep had legs to take them to it.

The right centre, therefore, would be at the centre of the land from which the produce is brought to the homestead, and to which the manure is returned. The existence of a canal or railway-station would require special consideration, as would also the possibility of obtaining water as a motive power. A plentiful supply of good water for the stock is a vital point; and the quality of soil is not to be neglected. Chalk or gravel is best, and clay or springy sand the worst. In balancing the *pros* and *cons*, it should be borne in mind that of existing objections some might be remediable, others not so; and these latter should be allowed the greater influence in determining the site.

The aspect of the projected steading would be the next consideration. The Romans were so impressed with the importance of a good aspect, that their writers on farm buildings laid down the most stringent rules for obtaining it. To secure the greatest benefit from the sun, and protection from cold winds, the homestead should be so placed that a north and south line should be the diagonal to its square. There could be no difficulty in determining, as another settled principle of universal application, that the most ample means of ventilation should be provided, so that the air within the buildings might be always pure, and admitted without draught. There was some truth both for man and beast in the old proverb—

> "When the wind comes in at a hole,
> Then it's time to think of your soul."

Rotten lungs, broken wind, and damaged sight, were some of the more prominent evils which the absence of pure air inevitably induced in men and cattle. "For that which befalleth the sons of men, befalleth beasts; even one thing befalleth them—as the one dieth, so dieth the other: they have all one breath."

Modern chemistry has established the fact that digestion is slow combustion, and food fuel. The bear lays in fat at the approach of winter to keep him warm through its frosts. It is then necessary, as a matter of economy, to keep the stock warm, as conducive to condition. Fatting-stock requires more warmth, and should therefore have more sheltered buildings, than growing stock, with which the development of muscle is of more importance than fat. But the rule of Nature is, use—not abuse. Warmth creates fat; but too much warmth melts it; and this must be guarded against, and the means afforded of regulating heat and cold, otherwise it will be found that what was right for one season would be wrong for another. It is the same with light. Its presence is an absolute essential to health; but its excess during the summer months is injurious, and at such times flies torment the animals to an injurious extent; control, therefore, over the admission of light is indispensable.

The question of box-feeding is so important in its bearing on agriculture, and in its influence on the arrangement of a homestead, that it is necessary to determine this point as a principle before proceeding with our plan. The objections made to box-feeding, when originally introduced, were based chiefly on the injury

caused to the health of the animals by the foul air generated, and the filth in which animals so kept were always immersed. If these objections had been irremediable, they would certainly have been fatal to the system ; but the simple remedy, devised by Mr. Blundell, of placing a layer of earth, about 12 inches thick, at the bottom of each box, has the effect of fixing the ammonia and of absorbing the liquid portion of the manure, so that the animals can remain in these boxes without injury to their health and comfort; and the manure thus prepared and stored is very greatly increased in value, while the labour of foddering the animals is considerably diminished.

So much of the cost of all farming operations is reducible to labour, and so much of this labour is connected with the homestead, that the arrangements of the latter should be especially framed so as to economise time. To ensure such a result, the buildings should be so placed in respect to each other that no ground should be traversed twice without result, and no step taken beyond what is necessary. The great principle of profitable circulation should be apparent throughout. The everyday work at a farmery is to thrash out the produce from the straw, and to convey the latter to the stock for bedding and conversion into manure, which is to be carried out to some convenient spot preparatory to its return to the fields. The destination of the corn, hay, and root stores dictates their position at the head of the steading. The straw and the hay have to be cut into chaff, the roots to be washed and minced, or boiled, and the corn to be thrashed and stored. The conveniences and appliances for these several works must, therefore, be close to the objects operated on, and of ready access to the feeding-trucks. The root-stores should be so arranged that carts could back into them. As corn keeps better in ricks than in barns, the ricks should be placed on each side of a railway proceeding from the thrashing-place. The granary should be partly over the thrashing-place, partly over an open shed, to allow waggons to back under it to load, and adjacent to the feeding-passage, in order to supply the trucks with corn by a shoot. The stock-keeper, having taken up in the shortest time his load of roots, chaff, straw, or hay, should be able to deliver this in the readiest way to the animals he has to tend. To effect this the boxes for stock must be placed on each side of the feeding-passages, which proceed direct from the stores. These passages should have an inclination from the stores, so that the labour of running the loaded truck down to the stock may be equal to that required to return it back when empty. To make this truck travel easier, running planks should be fixed in the feeding-passages, or a light railway formed by screwing light half-round iron on wooden sleepers. This cheap railway should be continued through the several stores, and between the hay, straw, and corn-ricks, and turn-tables formed where necessary, of equally simple construction. As the chief bulk of produce is brought gradually from the end of the rick-yard, first to the stores and then to the stock, the railway should have a fall from its end in the rick-

yard through its whole extent. This railway would then bring the corn from the ricks to be thrashed, take back the straw to be stacked, and return it, as required, to the feeding-boxes. The necessity for large barns is thus avoided.

The question between fixed and locomotive engines is a most important one. There is no doubt that fixed engines work the best, and with the greatest economy; and the point must be decided by the consideration, whether there is work enough at the homestead to keep the engine sufficiently employed to pay; or whether, from the nature or situation of the land, a locomotive could be employed at different parts of the farm with greater advantage. As a general rule, a fixed engine would be best for a large farm, a locomotive for a small one. In designing a farmery, therefore, where this point was not settled, it would be necessary to place the shed for the engine and boiler so that an engine could be backed into it. The engine should be close to its work, and so placed as to give direct action to all its working parts. This saves first cost and working cost. Horse-power might be occasionally used with advantage, and the thrashing-floor should be so placed as to admit of this; and a floor for a little occasional flail-thrashing would be convenient. The fuel-house should be close to the engine-room, and accessible to carts. If sawing by steam is to be done, the carpenter's shop should be near the engine-room. The waggon and cart-shed should be near the horse-boxes, so that the animals may pass at once into their lodgings when out from their waggons. For a similar reason the implement-shed should also be near the horse-department. The sheep-house should be connected with an open yard; and it should be little more than an open shed, as no animal suffers more than sheep from heat and overcrowding. The piggeries should consist of breeding-boxes, and boxes for store-pigs and fatting-pigs. Pigs are very apt to overlay their young. To prevent this a batten should be placed round the breeding-boxes, about 9 inches off the wall and the ground. No animal pays better for the comfort and warmth given him, and these points should be considered in his domicile.

Having thus considered the general arrangement and accommodation needed for the stock, he would proceed next to consider the most economical and durable mode of construction. The locality must determine in many cases the materials to be employed; and this would also to some extent regulate the method of construction. The corn and hay-stores, the engine-room, and the granary would be the only parts requiring thick walls, whether of brick or stone, and heavy timbers. The box-system being a multiplication of similar parts, it is advisable, as a principle, to construct the boxes with details of simple form, of small scantlings, and few in kind, so that they can be easily put together, and easily replaced when damaged, while capable of extension or alteration, and shift in use —points of importance—for which the box-system offered great facilities, which the design now exhibited attempts to embody.

Mr. Elliot then referred to the plans and sections before him,

designed especially to carry out the principles laid down, which, he observed, were but the legitimate deductions from the views advocated in those plans and essays submitted by himself and Mr. Spooner, for the National Competition for Farm Buildings, in 1849, which the Council selected as the first of the "Commended designs," and directed to be inserted in the Journal of 1850. On that occasion Mr. Blundell aided with his valuable advice; and, in the present instance, the plans are the joint work of himself and Mr. Blundell.

It would be observed on reference to the plans that the whole accommodation is contained in one block of buildings; the cattle-lodgings or boxes being all 12 feet square, with feeding-passages between each double line. Although the buildings are thus brought into one block, the necessity for massive roofs and lead gutters is obviated by keeping the roofs of the feeding-passages lower than those over the boxes, and attaching common iron eaves-gutters to each set of roofs: thus no roof is required of more than 24 feet span. The external walls are of brick, and the continuous pits in the lines of the cattle-lodgings are divided off into boxes by moveable iron hurdles suited to different kinds of stock, or by battens, where the first expense is more thought of than durability. The two sets of sections show two modes of construction—one with roofs formed of timber and slate, the other of galvanised corrugated iron. In the latter case the buildings would be fire-proof, and the cost little more than that of a common roof, the span being so small. In either mode of construction the use of lead gutters is dispensed with. The engine is so placed as to give the most direct action to all the machinery it may have to work. The arrangements give great facility for supplying and inspecting the stock, removing and storing the manure; and the mode of constructing and arranging the fittings of the boxes affords every facility for such change of use as the varying conditions of the farm might require. The whole building is but a repetition of simple parts and of small scantlings, which unskilled workmen could put together without difficulty.

A cheap pavement or bottom for the boxes and feeding-passages is of moment; and no plan can answer better than a concrete of tar and gravel. The gravel should first be put in heaps, with sufficient tar and fuel to light it; and when the mass is thoroughly heated, the tar for mixing should be poured in, and the whole spread while hot about 4 inches thick. This method had been extensively used for the footways at Southsea, and answered its purpose admirably. Over this bottom, so prepared, should be placed the layer of earth, about 12 inches thick, the key to the success of the box-system of feeding.

Mr. Blundell said that the question of improving farm buildings had long occupied his thoughts, and the plans now presented were the result of considering it in conjunction with his friend Mr. Elliot. That gentleman had explained the architectural value of the plans; and he now pledged himself as an agriculturist that they were well adapted to the purposes for which they were intended. The feeling in favour of the covered yards was now

pretty generally prevalent, and that method was combined in his plan with the system of box-feeding recommended in the Prize Essay and Commended Essay published in the Journal of the Society in 1850. In designing these buildings, the particular object had been to adapt them to farms of various sizes, and for animals of various conditions.

He knew that a feeling existed in the minds of many that the system of horse-boxes, with the manure accumulating under the animals, could not be worked out to advantage. But he himself had put it into operation, and that in a most satisfactory manner, in buildings of his own design, upon the property of a gentleman for whom he had been agent. In one instance the manure was allowed to accumulate for nine months, and in another for fifteen months, yet the horses were in the most perfect condition; no disease was engendered during the whole time, and the manure was as solid and good as possible. This, however, was only attainable by good management and the issue of proper instructions to the groom and stable-keeper. He had ordered his boxes to be supplied with straw cut from fifteen to twenty inches long, which was done by means of a thatcher's knife. When the straw was much longer, it hung to the horses' hoofs, and the surface of the earthen floor became irregular. The air then entered, fermentation ensued, and the boxes became more or less the seat and cause of disease. Water was sprinkled over the surface with a water-pot and hose one or twice a day, and a little sand was used to give solidity to the mass. This method had answered exceedingly well, and he could recommend its adoption for racers and hunters as well as cart-horses, as he never saw horses' feet in better condition for shoeing than his were. The boxes were perfectly sweet, and a person led into them blindfolded would not detect from the smell that he was in the precincts of a stable. The foot of earth absorbed the urine; the ammonia was fixed immediately, and the boxes did not require to be cleaned out oftener than twice or three times a year. As in the case of the common stable, the olfactory nerves would tell when the earth ought to be removed from the boxes.

The premises sketched out on the plan were suited to an arable farm of 300 or 400 acres; or, where pasture predominated, a farm of 800 or 1000 acres. In the present day there were very few large farms from which steam-power was absent. That of course diminished the number of horses. The limit of the accommodation on the plan was for twenty-two horses, rather a small number, perhaps, for a holding of 800 or 1000 acres. But besides steam they had a powerful auxiliary in oxen. All the bullock-boxes were capable of furnishing accommodation for oxen; so that, whether the farm was 300, 500, or 1000 acres, the buildings would accommodate animals sufficient to convert the whole of the straw produced on the farm into manure.

With regard to ventilation, the heated air passed out at the roof above the animals' heads; and there was no draught. There was ample accommodation for young stock, breeding sows, and the

fatting of store pigs. There were six boxes for tying up twelve dairy cows. The boar-pen was placed by itself. There was a good lambing-shed; and if the farmer had a fancy for sheep-feeding under cover, he had the means of doing so at his command. He valued the stock which might be maintained on the premises at about 2500*l*.

The other advantages connected with the plan were the fire-proof nature of the structure, the railway facilities which were provided, the spacious and conveniently situated manure-house, the position of the waggon and implement sheds, the equal distribution of light over the whole building, and the ease with which the iron panels dividing the interior might be removed, and a covered yard substituted for boxes. It was desirable that gentlemen who intended to erect new farm buildings should have before them as complete a plan as possible; and to promote that end, the present design was now submitted to the Council.

The Discussion.

Sir E. Kerrison, M.P., said, that asphalte for boxes answered perfectly, and much better than the ordinary brick flooring.

In reply to Colonel Hood's inquiry, Mr. Elliot explained that in making a floor no more tar need be used than was necessary to set the mass on fire. The mixture should be burnt about twenty-four hours, and then spread at once on the floor.

Mr. Frere inquired if Mr. Elliot had considered the relative value of corrugated iron and zinc. Having himself formed a favourable impression of corrugated iron, he had consulted Mr. Clarke, an architect of experience in farm buildings at Newmarket, on the subject, but that gentleman objected to it on account of the difficulty of nailing, and the danger of its being rusted at the joints; and recommended, as an alternative, the use of zinc from the Vieille Montagne Mining Company.*

Mr. Elliot explained that in his plan no nailing was wanted. The span of the roofs was so small as only to require a tie-rod.

Sir E. Kerrison objected to the use of either zinc or corrugated iron for farm buildings of any description.

Mr. Blackburn thought the extraordinary conducting power of iron would render it detrimental as a roofing to any farmer who wished to stall-feed during the summer. He had found even galvanised iron roofs so intensely hot as to render an inner lining of felt necessary as a non-conductor.

Mr. Exall suggested that, if the roof were painted white, excessive heat would be avoided. Any white roof would resist the action of heat.

In answer to Mr. Frere, Mr. Elliot stated that the cost of carrying out the plan must of course depend very much upon

* This company has an office in London, at No. 12, Manchester Buildings, Westminster. They have furnished roofs for Passenger Station, Crystal Palace Railway; Bristol Station; and Reading Cattle Market, &c. &c., Great Western Railway; Gloucester and Chepstow Stations, &c., South Wales Railway; Tunbridge, Banbury, Frome, Worcester Stations, &c. &c.

the locality. But, taking an average, and of course excluding machinery and farmhouse, he should say that 1700*l.* would be a fair estimate.

Mr. Blackburn said that the accommodation provided for 50 head of cattle (or even for 100, if tied up in pairs), although satisfactory in 1850, hardly met the requirements of the present day. A proper value was not then set upon straw, which is worth something more than to be trodden under foot. Very few farmers would now like to bestow 20 lbs. of straw per day in litter, when stall-fed cattle could be kept in good condition on 12 or 14 lbs. a day, and with boards 5 lbs. a day was sufficient.

Mr. Blundell: The use of boards was more a question of manure than of feeding.

Mr. Blackburn: These boards, with a proper quantity of straw upon them, formed an admirable bed. They were non-conductors of heat, and a bed that was always dry. He considered that it must be prejudicial to the health of animals for them to lie on a collection of manure. It reminded him of the cesspool system.

Mr. Elliot preferred a bed of earth, as suggested by Mr. Blundell, to a floor of laths. The earth might be obtained from any part of the farm, and any one who observed the superior quality of the manure which came from the boxes must be satisfied that an abundant return was made to the land for the earth so taken and applied.

Mr. Blundell said he lived in a district where the soil was loamy, and he took the earth from about the hedges and ditches. It was gathered in heaps, left to stand about 12 months, and then put into the boxes.

A Member: Once or twice that might do; but it would take a great deal more than could be spared from the land to use it constantly.

Mr. Blundell objected to boarded floors, as unnatural and incompatible; besides, there was an exhalation from the pits that was most objectionable.

Fatting Bullocks on Arable Farms.

Mr. Blundell said, although this subject had been discussed at various times at the different farmers' clubs and other meetings, yet up to the present time there seemed to exist an under current of feeling, inducing the belief that fattening bullocks with corn and cake would not answer the purpose, were it not for the object of turning the straw produce of arable farms into good manure. This question presents two aspects—viz., the economy of feeding the animals, and the economy of making the manure. In connection with the former, the points which should engage attention are:—1. The sort or breed of the animals. 2. The best age to begin fattening. 3. The condition at the commencement of fattening. 4. The preparatory or probationary state of the animals. 5. The kind of food. 6. The quantity of food. 7. The time of feeding, and state of the food. And 8. The accommodation most likely to insure the health and well-doing of the animals. Under the latter division, the points for consideration are—the value of the manure

in relation to the food which the animals received, and the accommodation for making and preserving it.

The following statement, extracted from his farming account-book, contains the result of feeding 37 head of bullocks, of different ages, during the last three years, upon his own farm:—

Dr.	£.	s.	d.
15 oxen and steers purchased at	220	15	0
8 cows valued at	102	0	0
14 heifers and steers, average age 17 months, valued at	171	0	0
To balance increased value	435	5	0
	929	0	0
Cr.			
15 oxen and steers sold for	408	10	0
8 cows sold for	184	15	0
14 heifers and steers, sold for	335	15	0
	929	0	0

In analysing the above account he was enabled to furnish some interesting results, calculated to show the comparative advantages of fattening stock of different ages:—

	£.	s.	d.
14 oxen and steers, being kept on an average of 8 weeks' summer feeding in a preparatory state, increased in value 7*s.* per week	39	4	0
23 oxen, steers, and cows kept 20 weeks each, winter feeding, in a fatting state, increased in value 10*s.* per week	230	0	0
14 heifers and steers, kept 20 weeks each, winter feeding, in a fatting state, increased in value 11*s.* 9*d.* per week	164	0	6
	433	4	6
Deduct the summer and preparatory feeding for 14 bullocks	39	4	0
	394	0	6
The actual increased value of 37 bullocks during 20 weeks each, winter feeding, being	396	1	0
The general average of weekly increased value 10*s.* 8*d.*	394	13	3

He would now lay before them his account of feeding in two ways—viz., the preparatory or summer feeding, and the fatting or winter feeding:—

1. *Account of Keeping a Bullock in a Preparatory State by Summer Feeding.*

Dr.	s.	d.
To 3 lbs. of oilcake per day, or 21 lbs. per week, at 12*l.* per ton	2	3
To 80 lbs. of clover per day, at 9*d.* per rod, the rod weighing 120 lbs.	3	6
To 15 lbs. of litter straw per day, or 140 lbs. per week, at 15*s.* per ton	0	11
To attendance per week	0	6
To interest on capital and gain	1	2
	8	4

Cr.	s.	d.
By increased value of bullock per week	7	0
By value of manure per week	1	4
	8	4

2. *Account of Keeping a Bullock in a Fatting State by Winter Feeding.*

Dr.	s.	d.
To 4 lbs. of oilcake per day, or 28 lbs. per week, at 12*l.* per ton	3	0
To 1 lb. of bean-meal per day at 12*l.* per ton..	0	9
To 64 lbs. of mangold per day, or 448 lbs. per week, at 10*s.* per ton	2	0
To 20 lbs. of oat-straw fodder per day, or 140 lbs. per week, at 30*s.* per ton	1	10
To 20 lbs. of straw litter per day, at 15*s.* per ton	0	11
To attendance per week	0	6
To interest on capital and gain	3	0
	12	0

Cr.		
By increased value of bullocks per week	10	8
By value of manure per week	1	4
	12	0

These tables required some explanation, and the first inquiry that suggested itself was, how he had arrived at this quantity of food? His practical experience for some years past had led him to adopt a moderate system of feeding, as best calculated to yield a profit; and he objected *in toto* to bullocks being kept as mere manure-making machines, on the plea that a profit was not to be made out of them. If that assertion be admitted, would not the manure-dealers say that they could sell manures better and cheaper than they could be procured by the feeding of cattle? If his practice were not gainful he certainly would not continue it, but he was satisfied that it was profitable to him. The 4 lbs. of oilcake-meal per day in the last-mentioned table was the quantity he regularly gave, unless he kept the animals for exhibition, and then he added a pound of bean-meal per day; otherwise the cost of corn and cake never exceeded 3*s.* 9*d.* per week.

With regard to the 64 lbs. of mangold per day, or 448 lbs. per week, he had to thank this Society for having taught him, through the pages of its Journal, that a far less quantity of roots was sufficient than he had at one time supposed. In 1854 an essay, by Mr. Charles Lawrence, was published in the Journal, in which it was stated that 50 lbs. were sufficient for an animal, and would give a considerable increase: that statement first called his particular attention to the subject. He had been told right and left that if he gave mangold he would ruin his stock. Nevertheless, he had continued to feed sheep and bullocks for years upon it; and had ceased to cultivate swedes, for the simple reason that he liked eighteen pence better than a shilling; that he could grow 30 tons of mangold where he could grow but 20 tons of swedes; and 64 lbs. of mangold were, in his judgment, equal to 75 lbs. of swedes.

As to the 20 lbs. of oat-straw fodder, he had never yet seen the bullock that gave a profit by being fed upon hay; but he had been informed of numerous instances to the contrary. The reasons were, first, that the hay was too costly a material; and next, that the animal would not continue to eat his other food so heartily as when he was supplied with straw. When he ate straw he came to his food with the greatest zest and appetite; but when he ate hay, he often refused his food, the hay having a cloying effect upon the stomach, particularly when given with roots in large quantities. He never grew hay, therefore, but cut up his clover, and used it to feed his beasts under cover, in the preparatory state of summer feeding, believing that they thereby made as much meat again, as well as produced a valuable manure. Physiologically, ruminating animals require a large amount of straw to distend the stomach and carry out their peculiar process of digestion. The allowance of 20 lbs. of straw-litter per day during the winter feeding is also desirable.

He might be told that the sum of 10*s.* 8*d.*, at which he estimated the increased value of the bullock, was too large, considering the actual number of pounds' weight that can be gained in a week; but he must repeat once more that he was only now giving them the actual results of three years' feeding of stock of various ages, from which it appeared that his younger stock paid better than stock of full age.

One point under the head "economy of feeding," is the sort of animals to be kept; and he thought that the old established breeds, recognised by the Royal Agricultural Society at their annual shows—the Shorthorns, Herefords, Devons, and Scots—must also be recognised and preferred by the farmer. Crosses are, however, not to be despised if derived from a pure breed. For rearing he liked the Shorthorns best; and always brought up his calves under cover from the time of calving up to their being 22 or 24 weeks' old. The best age at which to commence fatting he took to be from 18 to 20 months. Some of his stock, which he sold in April last, had commenced feeding on the 1st of November preceding, at which time two of them were 17 months old, and the average weight of the beasts when sold was 98 stone, odd pounds. It was not reasonable to suppose that animals that had been purchased after being driven about the country or taken from roaming about their own pastures, would get immediately used to their new life upon being placed in boxes, and at once do full justice to the amount of food supplied to them. Such animals should not be put on high feeding at once: he therefore adopted what he termed a preparatory state of feeding, for the animal should always be fleshy before it is put to high diet. Six or eight weeks were sufficient to detect the bad-doers among purchased animals. He was feeding at this time (in June) his calves, yearlings, and older stock, on clover. Mangold would succeed, and after that was gone he commenced with trifolium, clover, and the tops of carrots and turnips. He fed only twice a-day with roots, and had the mangold cut with a Gardiner's

cutter, the same as for sheep. He did not like pulping; and preferred feeding twice a-day to three times, because the animals come to the trough with a better appetite, and between the periods of feeding were induced to consume a larger quantity of straw than if they were fed oftener. He also objected to cutting into chaff so low-priced a commodity as straw; it did not pay for the cutting. With reference to the second division of his subject, there was no question that an animal would make a much larger amount of meat from the material it consumed if it could lie down comfortably; and he contended that a well-managed box, carefully littered with straw, as cleanliness dictated, was the best accommodation it could have. An animal which lay upon boards must lie in a distressed and unnatural condition; but one that lay upon earth lay comfortably; and his experience led him to prefer an earthen to a wooden floor. In regard to the value of the manure, he believed it could not be obtained at anything like the same cost by any other system as by box-feeding. It accumulated rapidly; and at the same time every atom, both liquid and solid, was preserved in the best possible form. As to the health and well-doing of the animals, during the three years in which he had been carrying on his system of feeding, he had never lost a single animal, or had one out of health, of any age, though when he used to feed on hay his bullocks were constantly out of health, and some days their stomachs were so clogged and cloyed that they would not eat a bit of cake. The quantity of straw for litter should not be less than 20 lbs. a-day, which would give a ton of dung per month.

Lord Powis (the Chairman) remarked, with reference to the plan of the buildings, that some sites might not be sufficiently level to admit of the erection of such a large mass of continuous buildings, but the lines and subdivisions on the plan seemed to indicate that to meet such a difficulty the buildings might be arranged in greater lengths and shorter depths.

Mr. Elliot thereon pointed out that the plan naturally divided itself into three sections, and would therefore suit ground of any levels.

Mr. Blundell considered the whole range to be but an aggregate of distinct areas, each of 12 feet square.

Lord Powis also pointed out that the multiplication of short spans in the roofs, so as to dispense with the use of large timber, is worthy of attention, especially in localities where timber, being scarce, has to be brought from a considerable distance. If the meeting of the roofs over a spout were sufficiently water-tight in stormy weather and at all seasons of the year, it certainly would be extremely useful, and would get rid of the difficulties which are generally attendant on the ordinary valleys between two sets of buildings, from the expense caused by the use of great quantities of lead, and the danger of leakage, when through neglect or carelessness the lead is insufficient.

Mr. Spooner said that, having had frequent opportunities of witnessing the manner in which Mr. Blundell treated his cattle, he

could bear testimony to the great comfort which they seemed to enjoy, and the striking contrast they presented to the miserable beasts he had seen tortured on laths, through which the manure was constantly running, as well as a cold current of air, which robbed them of the vital warmth so necessary to their well-doing.

With regard to the practice of cutting straw into chaff, it struck him forcibly that everything which is new is not sound, and some things which are old deserve reconsideration. To use straw to the best advantage the better portion of it should be eaten by the stock and the inferior part used as litter. The benefit thus gained would go far to counterbalance any disadvantages that might be supposed to arise from omitting to cut straw into chaff.

He could speak particularly of the excellence of the plan which Mr. Blundell had adopted of giving his cake, reduced to meal, with the roots, which are thus prevented from chilling the blood and depriving the animal of the requisite heat.*

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* In this discussion an objection is made to cutting straw into chaff on the ground of the labour, and consequently the cost involved. But the fact must not be overlooked that this work is done at a slack time of year on all farms, particularly on those light-land farms not requiring drainage, which are chiefly under the plough and grow large crops of straw. It is hard to put any price upon work if the necessary alternative would be to send able-bodied men to the workhouse. In foreign countries the sight of a small peasant proprietor making improvements at any cost of labour rather than stand still in winter, brings forcibly under the Englishman's notice the weak side of our national system of agriculture, as conducted by tenants and hired labourers.—P. H. F.

LIST OF AGRICULTURAL PATENTS FOR THE YEAR 1861.

[Compiled from the Commissioners of Patents' Journal.]

In this list such patents only as originated in the year 1861 are given: several patents which were completed, but did not originate within the year, are for this reason omitted.

8. John Finney Belfield, of Primley Hill, Paignton, in the county of Devon, gentleman, for an invention of *Improvements in reaping and mowing Machines.* Application for patent dated 2nd January, 1861; notice to proceed gazetted 26th February; patent sealed 9th April; Belgian patent dated 31st July.

13. Charles Stevens, Office for Patents, Welbeck-street, Cavendish-square, *An improved apparatus for stopping runaway horses.* A communication. Application dated 3rd January.

78. Henry Thomas Hooper, of Truro, Cornwall, and William Gerrans, of Tregony, Cornwall, *An improved machine for distributing manure on lands.* Application dated 11th January; notice, 21st May; patent sealed 9th July.

142. Robert Mason, of Alford, Lincoln, implement-manufacturer, *Improvements in apparatus for washing and churning.* Application dated 18th January.

154. Donald Mann, of Rochester, State of New York, U. S. America, *Improvements in rotary spading and digging machines.* Application dated 19th January; notice, 9th April; American patent, 23rd April; English patent sealed 22nd May.

173. Robert Henderson, Bayswater-road, Middlesex, trainer of horses, *An improved dumb-jockey for breaking or training horses.* Application dated 22nd January; notice, 5th February; patent sealed 16th July.

201. Richard Archibald Brooman, patent agent, 166, Fleet-street, London, *Improvements in reaping and mowing machines.* A communication. Application dated 25th January.

205. Alfred Fernandez Yarrow, of Arundel-square, Barnsbury, engineer, and James Bracebridge Hilditch, of Barnsbury Villas, both in Middlesex, *Improvements in means or apparatus used in ploughing, tilling, or cultivating land.* Application dated 25th January; notice, 4th June; patent sealed 16th July.

249. Henry Phillips, of Pinhoe, Devon, and James Bannehr, of Exeter, *Improvements in urinals, and in the manufacture of manure when urine is used.* Application dated 30th January; notice, 21st May; patent sealed 16th July.

251. George Tomlinson Bousfield, of Loughborough Park, Brixton, Surrey, *Improvements in the manufacture of shoes for horses and other hoofed animals.* A communication. Application dated 30th January.

276. Thomas Edward Knightley, of 25, Cannon-street, City of London, *Improvements in constructing stable-floors.* Application dated 1st February; notice, May 21st; patent sealed 23rd July.

280. John Cameron, of the Hematite Ironworks, Hindpool, Lancashire, *Improvements in purifying water for the supply of steam-boilers and other uses.* Application dated 2nd February; notice, 28th May; patent sealed 30th July.

327. Hicks Withers, of Dundalk, Ireland, veterinary surgeon, H.M.R.A., *Improvements in horse-shoes.* Application dated 9th February; notice, 5th March; patent sealed 6th August.

424. Thomas Richardson, of Newcastle-upon-Tyne, *Improvements in the manufacture of manure.* Application dated 20th February.

428. Jules Dutilleul, of Paris, *A rotative whistle of alarm applicable to steam-boilers, indicating the level of the water.* Application dated 21st February; French patent, 16th February.

443. Henry Griffiths Prossor, of Waterford, merchant, *Improvements in the mode of and apparatus for singeing the hairs off from the carcases of pigs.* Application dated 22nd February; notice, 2nd July; patent sealed 16th August.

452. Robert and William Cuthbert, Newton-le-Willows, Yorkshire, agricultural implement manufacturers, *Improvements in reaping-machines and grass-mowing machines.* Application dated 22nd February; notice, 14th May; patent sealed 21st June.

458. Charles Stevens, 31, Charing Cross, Middlesex, *Improved elastic horse-collar.* A communication. Application dated 23rd February; patent sealed 15th August.

460. Hugh Mackenzie, of Ardross and Dundonnell, county of Ross, N.B., *Improved means of applying the water of rivers for driving mills without weirs or other obstruction to the passage of salmon and other fish.* Application dated 23rd February; notice, 25th June.

468. Joseph Warren, of Maldon, Essex, *Improvements in chaff-cutting machines.* Application dated 23rd February; notice, 26th March; patent sealed 7th June.

475. Charles Sallows, of Maidstone, Kent, agricultural machinist, *An invention for improving the action or motion of the Kent brush-drill at present used in agriculture.* Application dated 25th February; provisional protection granted 22nd March.

476. William Gale Smith, of Elizabeth Port, Union County, State of New Jersey, U. S. America, *An improvement in the cutting-apparatus of harvesters.* Application dated 25th February; notice, June 11th.

484. James Howard, agricultural engineer, and Edward Tenney Bousfield, engineer, both of Bedford, *Improvements in the construction of windlasses and implements applicable to steam-cultivation.* Application dated 25th February; provisional protection, 29th March; patent sealed 7th May.

523. Frederick Tolhausen, C.E. and patent agent, Paris, *A new or improved machine for gathering and binding the sheaves or gavels of corn or other harvest produce, applicable to harvesting-machines.* A communication. Application dated 1st March.

528. Levi Lemon Sovereign, of 302, Strand, Middlesex, *An improved agricultural implement for cultivating land and for sowing seed.* In part a communication. Application dated 1st March; provisional protection, 15th March; notice, 9th July; patent sealed 30th August; Belgian patent 5th November.

566. Andrew Gibson Corbett, of Glasgow, N.B., merchant, *Improvements in constructing and draining floors suitable for stables and other places.* Application dated 5th March; provisional protection, 15th March.

597. Joseph Bunnett, of Deptford, Kent, engineer, *Improvements in the manufacture of bricks and tiles and in machinery for that purpose.* Application dated 11th March; provisional protection, 22nd March.

605. James Tomlinson, of Kegworth, Leicestershire, *An improved buckle-plate or apparatus used for attaching and detaching horses when in harness, or for other purposes.* Application dated 12th March; notice, 16th July; patent sealed 5th September.

636. William Hodson, Hull, Yorkshire, *Improvements in propelling and steering carriages, and also ploughs and other agricultural implements.* Application dated 14th March.

641. Bernhard Samuelson, of Banbury, Oxon, engineer, *Improvements in machines for breaking up and cultivating land.* Application dated 15th March; provisional protection, 29th March; notice, 2nd July; patent sealed 12th September.

649. George Dixon, of 26, Cecil-street, Strand, *Improvements in ploughs.* A communication. Application dated 15th March; provisional protection, 10th May; notice, 16th July.

654. Augustus Smith, of Brentwood, Essex, *Improvements in machinery for cleansing or dressing bass, flax, and other vegetable fibres, applicable also to the threshing of corn and other grain.* Application dated 15th March; provisional protection, 29th March; notice, 7th May; patent sealed 12th September.

661. William Cloutman, of Calverton, Berks, *Improvements in tanks or vessels for dairy use.* Application dated 15th March; provisional protection, 29th March.

666. Charles Stevens, patent agent, Charing Cross, *Improved agricultural implements.* A communication. Application dated 16th March; provisional protection, 5th April.

684. Jacob Jervell, of Molde, Norway, *An invention of the preparation of fish and sea-animals for manure.* Application dated 19th March; provisional protection, 12th April.

696. John Ridley, of Stagshaw, Northumberland, *An improvement in reaping-machines.* Application dated 20th March; provisional protection, 19th April; notice, 30th July.

730. John Potter, of Leeds, Yorkshire, *Improvements in the construction of wire and other similar fences.* Application dated 22nd March; provisional protection, 5th April; notice, 16th July; patent sealed 30th August.

737. John Spencer, of Doncaster, Yorkshire, agricultural implement-maker, *Improvements in the construction of harrows.* Application dated 23rd March; provisional protection, 5th April; notice, 14th May; patent sealed 19th September.

741. Paul Rapsey Hodge, of Lee, Kent, *Improved inverted hydraulic-press for pressing hay, straw, hops, hemp, flax, cotton, or animal wool, &c.* Application dated 25th March; provisional protection, 5th April; notice, 23rd July; patent sealed 19th September.

757. John Smith, Jun., of Coven, Staffordshire, and John Birch Higgs, of Brewood, Staffordshire, *Improvements in thrashing-machines.* Appli-

cation dated 26th March; provisional protection, 5th April; notice, 11th June; patent sealed 30th August.

790. Daniel Sutton, of Banbury, Oxon, *Improvements in apparatus for hanging gates.* Application dated 30th March; provisional protection, 12th Aprii; notice, 13th August; patent sealed, 19th September.

797. Gregorio Russo, of Genoa, Sardinia, *A new method of colouring as a substitute for saffron in the manufacture of cheese, pastes, &c., in which saffron is employed.* Application dated 1st April; provisional protection, 12th April; Italian patent prolonged, 19th June.

818. Thomas Edward Wilson, of Gornholme, Lancashire, *Improvements in machinery for agricultural purposes.* Application dated 3rd April; provisional protection, 12th April.

824. Adam Carlisle Bamlett, of Middleton Tyas, Yorkshire, farmer, *Improvements in reaping and mowing machines.* Application dated 3rd April; provisional protection, 12th April; Belgian patent, 14th February; English patent sealed 17th July.

876. Francis Taylor, of Romsey, Hants, *Improvements in apparatus for receiving, drying, and deodorising human excrement.* Application dated 9th April; provisional protection, 19th April; notice, 13th August; patent sealed 26th September.

894. Charles Noyes Kernot, of West Cowes, Isle of Wight, and Martin Diedrich Rucker, of Fenchurch-street, London, *An invention for obtaining ammoniacal salts and other valuable products from liquors or substances containing ammonia, and for utilising the residuum.* Application dated 11th April; provisional protection, 10th May; notice, 20th August. Improved application, 11th October; provisional protection, 8th November; notice, 19th November; patent sealed 26th December.

967. John Ridley, of Stagshaw, Northumberland, *Improvements in cutting apparatus for reaping and mowing machines.* Application dated 19th April; provisional protection, 3rd May.

1009. Edward Hammond Bentall, of Heybridge, Maldon, Essex, *Improvements in constructing the framing of various kinds of agricultural implements.* Application dated 23rd April; provisional protection, 9th May; notice, 6th August; patent sealed 26th September.

1010. Edward Hammond Bentall, of Heybridge, Maldon, Essex, *Improved machinery for cutting or pulping roots to be used as food for cattle.* Application dated 23rd April; provisional protection, 3rd May; notice 6th August; patent sealed 26th September.

1018. Emile Lecot, of 26, Cecil-street, Strand, *An improved nose-bag for horses.* A communication. Application dated 24th April; provisional protection, 10th May.

1019. Charles Stevens, patent agent, Charing Cross, *A new artificial manure.* A communication. Application dated 24th April; provisional protection, 10th May; notice, 27th August; patent sealed 3rd October.

1027. Edward Hammond Bentall, Heybridge, Essex. *Improved apparatus for transmitting motion to machinery to be driven by horse-power.* Application dated 24th April; provisional protection, 10th May; notice, 6th August; patent sealed 26th September.

1072. François Antoine Thonier, of Bourbon l'Archambault, France, *A reaping machine, called Thonier's Reaping Machine.* Application dated 29th April; provisional protection, 7th June; Belgian patent, 29th April, 1861; French patent, 1st May, 1860.

1102. Laurent Glatard, of Roanne, France, *Improvements in horse-draughts and carriage fittings, allowing to take all at once horses from carriages when running away, and to lock the wheels of the said carriages.* Application dated 2nd May ; provisional protection, 7th June ; notice, 27th August ; patent sealed 24th October ; Belgian patent, 18th May, 1861 : French patent, 12th January, 1860.

1120. William Addy, of Manchester, mechanic, *Improvement in machinery for washing fabrics and for churning.* Application dated 3rd May ; provisional protection, 17th May ; notice, 10th September ; patent sealed, 24th October.

1125. William Collett Homersham, of Adelphi-terrace, Middlesex, *Improvements in engines and implements for ploughing and cultivating land, &c.* Application dated 3rd May ; provisional protection, 17th May ; patent sealed 10th October.

1132. George Ager, LL.D., of Aylsham, Norfolk, *Improvements in means or apparatus for breaking or opening land.* Application dated 6th May ; notice, 4th June ; patent sealed 16th October ; Belgian patent, 16th November.

1139. William Johnson, of Little Malvern, Worcestershire, *Improvements in apparatus for churning and kneading.* Application dated 6th May ; notice, 27th August ; patent sealed 31st October.

1187. Andrew Dunlop, of Glasgow, N.B., *Improvements in endless or portable railways for facilitating the traction or draught of vehicles.* Application dated 10th May ; provisional protection, 24th May ; notice, 28th May ; patent sealed 24th October.

1200. Auguste César Achille Gérard de Melcy, of Paris, *an improved treatment of natural phosphate of lime for several purposes.* Application dated 11th May ; provisional protection, 24th May ; notice, 17th September ; Belgian patent, 27th June ; French patent, 8th May.

1203. Humfrey Swindells, of Handforth, Cheshire, *Improvements in collars for horses.* Application dated 11th May ; provisional protection, 24th May.

1219. William Smith, of Little Woolston, Bucks, *Improvements in implements and apparatus used when cultivating and tilling land.* Application dated 13th May ; provisional protection, 7th June ; notice, 25th June ; patent sealed 5th September.

1296. William Tasker, jun., Andover, Hants, *Improvements in machinery or apparatus for tilling or cultivating land.* Application dated 21st May : provisional protection, 31st May ; notice, 24th September ; patent sealed 31st October.

1301. Henry Bouthillier de Beaumont, of Geneva, *Improvements in ploughs.* Application dated 22nd May ; provisional protection, 31st May ; Belgian patent for *A plough with a turning mouldboard*, 16th May ; French patent, 10th May ; notice to proceed, 1st October ; English patent sealed 19th November.

1321. Henry Waller, of Lickhill, near Calne, Wilts, *An improved horse-rake.* Application dated 25th May ; provisional protection, 7th June.

1332. William Bosworth Holbeck, of Thurlaston Lodge, Leicestershire, *Improvements in apparatus for sowing seed.* Application dated 27th May ; provisional protection, 7th June ; notice, 1st October ; patent sealed 19th November.

1333. William Newzam Nicholson, of Newark-on-Trent, *Improvements in machines for making and collecting hay, &c.*, parts of which improvements are applicable to *cutting thistles and other weeds.* Application dated 7th May; provisional protection, 7th June; notice, 8th October; patent sealed 23rd November.

1221. Richard Hornsby, jun., Grantham, Lincolnshire, *Improvements in ploughs, &c.* Application dated 13th May; notice, 4th June; patent sealed 22nd August.

1232. James Howard and Edward Tenney Bousfield, both of Bedford, *Improvements in apparatus to be employed in steam-cultivation.* Application dated 14th May; notice, 11th June; patent sealed 19th July.

1252. Charles Clay, of Walton, near Wakefield, *Improvements in implements for cultivating land suitable to be worked by steam or other power.* Application dated 16th May; provisional protection, 31st May; notice, 17th September; patent sealed 12th November.

1254. John Leakey Bowhay, of Modbury, Devon, *Improvements in reaping and mowing machines.* Application dated 16th May; provisional protection, 31st May.

1342. John Halliwell, of Baslow, Derbyshire, *Improvements in churns.* Application dated 29th May; provisional protection, 21st June; notice, 8th October; patent sealed 23rd November.

1347. William Peacock Savage, of Roxham, Norfolk, *Improvements in reaping and mowing machines.* Application dated 30th May; provisional protection, 14th June; notice, 8th October; patent sealed 23rd November.

1348. Frances Ann Whitehead, of Chelsea, *Improvements in treating cream or milk, and in obtaining butter, &c., therefrom.* Application dated 30th May; provisional protection, 14th June; notice, 25th June; patent sealed 5th September.

1349. Charles Garrood, of Penge, Surrey, *improved horse-rakes and harrows.* Application dated 30th May; provisional protection, 14th June.

1379. Robert Charles Ransome, of Ipswich, *Improved reaping and mowing machines.* A communication. Application dated 1st June; provisional protection, 14th June; notice, 1st October; patent sealed 23rd November.

1381. Charles Garrood, of Penge, Surrey, *Improved cultivators and horse-hoes.* Application dated 1st June; provisional protection, 14th June.

1384. William Harwood, of Stow Market, Suffolk, *Improved reaping and mowing machines.* Application dated 3rd June; provisional protection, 14th June.

1402. J. L. and F. L. Hancock, of Pentonville, *Improvements in implements for pulverising, ploughing, and grubbing land, and in applying motive power for working agricultural implements, &c.* Application dated 4th June; provisional protection, 14th June; notice, 8th October; patent sealed 3rd December.

1405. Anson Hubbell, of Salisbury-street, Westminster, *Impvovement in churns.* Application dated 4th June; provisional protection, 14th June.

1409. John Allen Williams, of Baydon, Wilts, *Improvements in machinery, &c., for cultivating land by steam power.* Application dated 4th

June; provisional protection, 14th June; notice, 8th October; patent sealed 3rd December.

1426. George Baker, of Birmingham, *A new or improved apparatus for churning, beating eggs, &c.* Application dated 6th June; provisional protection, 21st June; notice, 9th July; patent sealed 22nd August.

1451. Richard L. Cole, Kennington Road, *Improved glove for currying horses and cattle.* Application dated 7th June; provisional protection, 21st June; notice, 22nd October.

1461. James Howard and E. T. Bousfield, of Bedford, *Improvements in hay-making machines.* Application dated 8th June; provisional protection, 21st June; notice, 25th June; patent sealed 30th July.

1483. Robert Romaine, of Devizes, Wilts, *Improvements in machinery applicable to steam-cultivation.* Application dated 10th June; provisional protection, 21st June; notice, 25th June.

1502. William E. Gedge, 11, Wellington-street, Strand, patent agent, *Improved reaping and mowing machine.* A communication. Application dated 12th June; provisional protection, 19th July; notice, 24th September; patent sealed 19th November.

1521. Francis Gregory, of Manchester, *Improvements in machinery for cutting hay, chaff, &c.* Application dated 13th June; provisional protection, 28th June; notice, 22nd October; patent sealed 10th December.

1526. William Bayliss, of Monmore Green, Wolverhampton, *Improvement in chain-harrows.* Application dated 13th June; provisional protection, 28th June; notice, 22nd October; patent sealed 10th December.

1532. Thomas William Wedlake (Wedlake and Dendy), of Hornchurch, Essex, *Improvement in hay-making machines.* Application dated 14th June; provisional protection, 28th June; notice, 22nd October; patent sealed 10th December.

1540. William Smith, of Little Woolston, Bucks, *Improvements in machinery for giving motion to ploughs, cultivators, and other implements.* Application dated 15th June.

1569. Joseph Edward Kirby, of Banbury, Oxon, *Improvements in steam-engines and machinery for giving motion to agricultural implements and other machines.* Application dated 18th June; provisional protection, 28th June.

1589. William Gedge (Gedge & Son), patent agent, *Improved apparatus for drying, sifting, and cleansing grain and other agricultural produce.* A communication from A. A. Dubarde-Dubarbre, of Dijon, France. Application dated 20th June; provisional protection, 28th June; notice, 29th October; patent sealed 17th December.

1608. James Comrie, of Stirling, N.B., *Improvements in churns.* Application dated 22nd June; provisional protection, 19th July; notice, 5th November; patent sealed 17th December.

1667. Isaac Bragg, of Hensingham, Whitehaven, *Improvements in the construction of reaping and mowing machines.* Application dated 29th June; provisional protection, 19th July; notice, 5th November; patent sealed 26th December.

1624. Charles Stevens, patent agent, Charing Cross, *Improved noseband for stopping runaway horses.* A communication. Application dated 25th June; provisional protection, 5th July; notice, 29th October.

1628. John Fowler, jun., of Leeds, *Improvements in machinery for ploughing or tilling land by steam power.* Application dated 25th June; provisional protection, 9th August; notice, 15th October; patent sealed 13th December.

1688. John Simonton, of Belfast, *Improved traction-engine and apparatus for cultivating land.* Application dated 3rd July; provisional protection, 2nd August.

1724. Louis A. Keiley, of Kensington, and W. A. O'Doherty, of Swan-lane, Upper Thames-street, *Improvements in apparatus for facilitating the process of grass edge cutting, &c.* Application dated 6th July.

1731. Richard Hornsby, jun., of Grantham, *Improvements in machinery for washing, wringing, and churning.* Application dated 8th July; provisional protection, 26th July; notice, 6th August; patent sealed 16th October.

1735. Alfred Priest and William Woolnough, jun., of Kingston-on-Thames, *Improvements in machinery for drilling and hoeing land.* Application dated 9th July; provisional protection, 2nd August; notice, 12th November; patent sealed 26th December.

1742. Richard Hornsby, jun., of Grantham, *Improvements in thrashing-machines.* Application dated 9th July; provisional protection, 26th July; notice, 6th August; patent sealed 17th October.

1744. Thomas T. Chellingworth, of Buckingham-street, Adelphi, and Jonathan Thurlow, of Lambeth, *Improvements in traction-engines.* Application dated 10th July; notice, 19th November; patent sealed 31st December.

1752. Thomas Reeves, jun., of Bratton Westbury, Wilts, *Improvements in apparatus for applying salt or other material to the roots of weeds.* Application dated 11th July; notice, 19th November; patent sealed 31st December.

1767. Thomas Smith and George Taylor, of Ipswich, *Improvements in horse-rakes and cultivators, and in wheels for the same and other carriages.* Application dated 13th July; provisional protection, 2nd August; notice, 12th November.

1786. John Goucher, of Worksop, Notts, *Improvements in stacking corn and other crops.* Application dated 16th July.

1857. William M'Intyre Cranston, of King William-street, City, *Improvements in grass-mowing machines.* A communication from New York. Application dated 24th July; notice, 6th August; protection on specification, 6th August; patent sealed 26th September.

1898. William Henry Ash, of London, Canada West, *Improvements in reaping and mowing machines.* Application dated 30th July; provisional protection, 9th August; notice, 13th August.

1937. Francis Richmond and Henry Chandler, of Salford, and William B. Richie, of Belfast, *An improved sackholder.* Application dated 5th August; provisional protection, 4th October; notice, 10th December.

1970. John Gedge (Gedge and Son, patent agents), 11, Wellington-street, Strand, *Improved apparatus for beating or thrashing grain.* Application dated 8th August; provisional protection, 23rd August.

1971. John and William Coldwell, of Sheffield, *Improvements in the manufacture of sheep-shears.* Application dated 8th August; provisional protection, 23rd August.

1982. Charles Peters Moody, of Corton Denham, Somerset, *Improvements in construction of gates.* Application dated 9th August; provisional protection, 23rd August; notice, 17th December.

2007. Joseph Humpage, of Balsall Heath, near Birmingham, *A new or improved reaping and mowing machine.* Application dated 13th August; provisional protection, 23rd August.

2060. William Firth, of Leeds, *Improvements in machinery for digging or turning up soil, mowing, reaping, and other agricultural purposes.* Application dated 19th August; provisional protection, 30th August; notice, 24th December.

2078. Nicholas Fisher, of Milton, near Blisworth, Northamptonshire, *Improvements in implements for grubbing and cultivating land.* Application dated 20th August; provisional protection, 13th September; notice, 22nd October.

2081. Thomas Lambert, of Thorncroft Farm, Essex, *Improved implement for rolling ridges and furrows or straight work.* Application dated 21st August.

2097. Bernhard Samuelson, of Banbury, *Improvements in harvesting machines.* Application dated 22nd August; notice, 8th October.

2106. Joseph Dunn, of Alnwick, *Improvements in reaping-machines.* Application dated 23rd August; provisional protection, 13th September.

2155. Lemuel Dow Owen, of 481, New Oxford-street, *Improvements in ploughs.* A communication from the United States. Application dated 30th August; provisional protection, 18th October.

2159. Alexander Taille, of Agen, France, *An improved manufacture of manure.* Application dated 30th August; provisional protection, 13th September.

2160. William E. Gedge (Gedge and Son, patent agents), Wellington-street, Strand, *Improvements in thrashing-machines.* A communication from France. Application dated 30th August; provisional protection, 20th September.

2169. William Hensman, of Woburn, Beds, and William Hensman, jun., of Linslade, Bucks, *Improvements in apparatus for tilling land by steam.* Application dated 31st August; provisional protection, 18th October; notice, 22nd October.

2229. Charles Fenton Kirkman, of Lambeth, *Improvements in obtaining manure from sewerage and in apparatus employed therein.* Application dated 6th September; provisional protection, 20th September.

2264. William Stevens, of Hammersmith, *Improvements in mechanism, or apparatus for ploughing and cultivating land by steam and other power.* Application dated 12th September; provisional protection, 27th September.

2283. Henry Dixon, of Pendleton, Lancashire, and John R. Renner, of Liverpool, *Improvements in carbonising sawdust and other vegetable substances.* Application dated 13th September; provisional protection, 1st November.

2302. William Edward Gedge (Gedge and Son, patent agents), *Improved apparatus for drying grain.* A communication from France. Application dated 16th September.

2313. Weston Tuxford, of Boston, engineer, *Improvements in threshing-machines and in raising and stacking straw and other agricultural produce.* Application dated 16th September; provisional protection, 8th November.

2314. Bernhard Samuelson, of Banbury, engineer, *Improvements in harvesting-machines.* Application dated 17th September; provisional protection, 4th October; notice, 10th December.

2318. F. J. E. A. G. d'Olincourt, of 113, Rue de Flandre, Paris, *A new system of cultivating land and preventing disastrous effects of inundations.* Application dated 17th September; provisional protection, 18th October; Belgian patent, 8th October, 1861; French patent, 8th March, 1858.

2320. Joseph Statham, of Salford, and William Statham, of Openshaw, Lancashire, *Improvements in machinery or apparatus for mowing and reaping.* Application dated 17th September; provisional protection, 4th October.

2321. Joseph Lee and B. D. Taplin, of Lincoln, *Improvements in traction-engines.* Application dated 17th September; provisional protection, 27th September.

2327. Henry Wickens, of Token-House-yard, City of London, solicitor, *Improvements in reaping and mowing machines.* A communication from Canada. Application dated 18th September; provisional protection, 4th October.

2353. Joseph Christian Davidson, of Yalding, Kent, farmer, *Improvements in threshing-machines.* Application dated 20th September; provisional protection, 4th October.

2354. Charles Perman, of Salisbury, Wilts, *Improvements in machinery or apparatus for cultivating land.* Application dated 20th September; provisional protection, 18th October; notice, 22nd October.

2373. Henry Brinsmead, of Ipswich, *Improvements in apparatus for raising and stacking straw and other agricultural produce.* Application dated 23rd September; provisional protection, 4th October.

2407. Joseph Tessier, of No. 48, Rue St. Nicolas d'Antin, Paris, *Invention of new means of saccharifying corn and cereal grasses.* Application dated 26th September; provisional protection, 15th November.

2452. Denis Rérolle, of 4, South-street, Finsbury, *An improved steam digging-machine.* Application dated 2nd October; provisional protection, 25th October.

2487. John Lansley, of Brown Candover, Hants, *Improvements in the construction of ploughs, drills, scarifiers, and such like implements; the said improvements relating to the mode of guiding or steering the same.* Application dated 5th October; provisional protection, 8th November.

2568. John Gilbert, of Old Kent-road, engineer, *Improvements in endless railways.* Application dated 15th October; provisional protection, 25th October.

2576. Alfred Vincent Newton, patent agent, Chancery-lane, *Improvements in construction of grain and grass harvesters.* A communication from U. S. America. Application dated 16th October; provisional protection, 25th October.

2594. John Goucher, of Worksop, Notts, *Improvements in the beaters and drums used in thrashing-machines.* Application dated 18th October; provisional protection, 1st November.

2617. William Colborne Cambridge, of Bristol, *Improvements in the construction of harrows.* Application dated 19th October; provisional protection, 1st November; notice, 5th November; patent sealed 10th December.

2630. N. D. P. Maillard, of Dublin, *Improvements in ploughs.* Application dated 21st October; provisional protection, 1st November.

2505. John Chaplin Willsher, of Petches, Finchingfield, Essex, farmer, *Improvements in the construction of combined thrashing and dressing machines.* Application dated 7th October: provisional protection, 1st November.

2525. Thomas Tidmarsh, of Dorking, Surrey, agriculturist, *An improved artificial manure.* Application dated 9th October; provisional protection, 25th October.

2539. Abraham English, of Hatfield, Herts, *Invention of reins or apparatus for preventing horses falling.* Application dated 10th October; provisional protection, 1st November.

2555. Alfred V. Newton, patent agent, Chancery-lane, *Improved machinery for dressing or cleaning wheat and other grain.* A communication from U.S. America. Application dated 12th October; provisional protection, 25th October; notice, 10th December.

2641. Richard Archibald Brooman, of 166, Fleet-street, City of London, *Improvements in reaping-machines.* A communication from C. H. M'Cormick, of Chicago, U. S. America. Application dated 22nd October.

2647. John William Wilson, of Barnsley, Yorkshire, timber-merchant, *Improvements in machinery for digging and cultivating the soil, and in steam-engines for agricultural purposes.* Application dated 23rd October; provisional protection, 29th November.

2666. Robert Andrew Boyd, of Southwark, *Improvements in apparatus for singeing pigs.* Application dated 24th October; provisional protection, 8th November.

2753. A. F. Yarrow, of Arundel-square, Barnsbury, and J. B. Hilditch, of Barnsbury Villas, both in Middlesex, *Improvements in machinery used when ploughing, tilling, or cultivating land by steam-power.* Application dated 2nd November; provisional protection, 15th November.

2771. John Ashley, of Bath, LL.D., *Improvements in apparatus for attaching horses to carriages.* Application dated 4th November; provisional protection, 22nd November.

2798. Henry Gould Gibson, of Mark-lane, city of London, *Improvements in apparatus for drying hops, malt, grain, &c., part of which is applicable as a fan or blower.* Application dated 7th November; provisional protection, 22nd November.

2802. Thomas Churchman Darby, of Little Waltham, Essex, farmer, *Invention of hoeing growing crops and ploughing.* Application dated 8th November.

2818. Samuel William Campain, of Deeping St. Nicholas, Lincolnshire, farmer, *Improvements in apparatus for stacking straw and other produce.* Application dated 9th November; provisional protection, 22nd November.

2854. Thomas Procter, of Boston, millwright, *Improvements in carriers or stackers, or apparatus for facilitating the stacking of straw, hay, or agricultural produce.* Application dated 13th November; provisional protection, 22nd November.

2871. F. R. Hughes, of Borrowstounness, and T. Richardson, of Newcastle-on-Tyne, *Improvements in treating certain natural saline compounds to fit them for agricultural use, and in order to obtain potash and other salts.* Application dated 14th November; provisional protection, 6th December.

2876. James Spratt, of Camden Town, *Improvements in the preparation of food for hogs, dogs, cats, and poultry, and in apparatus for the same.* Application dated 15th November; provisional protection, 29th November.

2884. Matthew Gibson, of St. Andrew's Works, Newcastle-on-Tyne, *Improvements in reaping and mowing machines.* Application dated 16th November; provisional protection, 29th November.

2948. William Bray, of Deptford, engineer, *An improved locomotive apparatus particularly adapted to agricultural purposes.* Application dated 23rd November; provisional protection, 6th December.

2957. William Burgess, of Newgate-street, city of London, *Improvements in reaping and mowing machines.* Application dated 25th November; provisional protection, 13th December.

2961. Alfred Vincent Newton, patent agent, Chancery-lane, *An improved method of removing and preventing the formation of calcareous and saline deposits in steam-boilers.* A communication by Lewis Baird, of Cambridge, Massachusetts, U.S. Application dated 25th November, provisional protection, 13th December.

2989. Alfred Vincent Newton, patent agent, Chancery-lane, *Improvements in mowing and reaping machinery.* A communication by Wm. Van Anden, of New York, U.S. Application dated 27th November. provisional protection, 13th December.

3019. John Cooper, of Ipswich, and Charles Garrood, of Penge, Surrey, *Improvements in cultivators, horse-hoes, horse-rakes, and harrows.* Application dated 30th of November.

3035. Wm. E. Gedge (Gedge and Son, patent agents), *Improvements in the manufacture of nosebags, &c., in apparatus connected with such manufacture.* Application dated 4th December; provisional protection, 27th December.

3039. James Edward Boyd, of Lewisham, Kent, *Improvements in scythes, scythe-handles, and apparatus for connecting the same.* Application dated 4th December; provisional protection, 27th December.

3045. Abraham Pullan, of New Cross, Surrey, and William Lake, of the same place, *Improvements in traction and other engines, and in wheels for ditto and other carriages, and in giving motion to ploughs.* Application dated 4th December.

3047. Allen Thomas Carr, of Soho, Middlesex, *Invention of the application of a material to the shoes on horses' feet for the purpose of preventing them slipping.* Application dated 5th December.

3053. William Busby, of Newton-le-Willows, Yorkshire, *Improvement in ploughs.* Application dated 5th December; provisional protection, 27th December.

3063. William Smith, of Kettering, Northamptonshire, *Improvements in the construction of horse-hoes.* Application dated 6th December; provisional protection, 27th December.

3064. James Howard, of Bedford, *Improvement in the construction of hay-making-machines.* Application dated 6th December; provisional protection, 20th December.

3102. Henry Tanner and William Procter, of Bristol, *Improvements in the method of applying manure to growing crops, and also in the machinery or apparatus for the purpose.* Application dated 11th December; provisional protection, 20th December; notice, 31st December.

3118. Augustus Tonnar, of Eupen, Rhenish Prussia, *Apparatus for drying and cleansing malt and other grain and seed intended for brewing, distilling, and agricultural purposes.* Application dated 12th December.

3139. John Kelly, of Brook Lodge, County Roscommon, *Improvements in the treatment of milk for the manufacture of butter, and apparatus for the same.* Application dated 13th December.

3171. Asmus Petersen, of Wittkiel, in Angeln, Schleswig, *An improved system of drainage and irrigation for meadow and other land.* Application dated 18th December.

3178. James Bannehr, of Exeter, *Improvements in apparatus for desiccating grain, seeds, &c.* Application dated 18th December.

3188. John Smith, Jun., of Coven, Staffordshire, *Improvements in thrashing-machines, and in mills for grinding, and in raising or moving grain.* Application dated 20th December.

3214. John H. Johnson, of 47, Lincoln's-inn-Fields, *Improvements in apparatus for cleaning wheat and other grain.* A communication by J. P. Fili, of Paris. Application dated 24th December.

3219. Edward Ede, of St. John's-wood, Middlesex, *Improvements in the construction of horse-shoes.* Application dated 24th December.

3242. Thomas Bright, of Carmarthen, *Improvements in machinery for cutting hay, straw, &c.* Application dated 27th December.

3254. Frederick Tolhausen, civil engineer and patent agent, Paris, *Improvements in machinery for reaping, gathering, and binding harvest-produce.* A communication by P. Durand. Application dated 30th December.

Royal Agricultural Society of England.

1862-3.

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*** The PRESIDENT, TRUSTEES, and VICE-PRESIDENTS are Members *ex officio* of all Committees.

MEMORANDA.

Address of Letters.—The Society's office being situated in the postal district designated by the letter W, members, in their correspondence with the Secretary, are requested to subjoin that letter to the usual address.

General Meeting in London, in December, 1862.

General Meeting in London, May 22, 1863, at Twelve o'clock.

Meeting at Worcester, 1863.

Monthly Council (for transaction of business), at 12 o'clock on the first Wednesday in every month, excepting January, September, and October: open only to Members of Council and Governors of the Society.

Weekly Council (for practical communications), at 12 o'clock on all Wednesdays in February, March, April, May, June, July, November, and December, excepting the first Wednesday in each of those months, and during adjournment: open to all Members of the Society, who are particularly invited by the Council to avail themselves of this privilege.

Adjournments.—The Council adjourn over Easter, Passion, and Whitsun weeks, when those weeks do not include the first Wednesday of the month: from the first Wednesday in August to the first Wednesday in November; and from the first Wednesday in December to the first Wednesday in February.

Diseases of Cattle, Sheep, and Pigs.—Members have the privilege of applying to the Veterinary Committee of the Society; and of sending animals to the Royal Veterinary College, on the same terms as if they were subscribers to the College.—(A statement of these privileges will be found in the present Appendix.)

Chemical Analysis.—The privileges of Chemical Analysis enjoyed by Members of the Society will be found stated in the Appendix of the present volume.

Local Cheques.—Members are particularly requested not to forward Country Cheques for payment in London; but London Cheques, or Post-office Orders on Vere-street (payable to H. Hall Dare), in lieu of them. All Cheques are required to bear upon them a penny draft or receipt stamp, which must be cancelled in each case by the initials of the drawer. They may also conveniently transmit their Subscriptions to the Society, by requesting their Country Bankers to pay (through their London Agents) the amount at the Society's Office (No. 12, Hanover Square, London), between the hours of ten and four, when official receipts, signed by the Secretary, will be given for such payments.

New Members.—Every candidate for admission into the Society must be proposed by a Member; the proposer to specify in writing the full name, usual place of residence, and post-town, of the candidate, either at a Council meeting, or by letter addressed to the Secretary.

Packets by Post.—Packets not exceeding two feet in length, width, or depth, consisting of written or printed matter (but not containing letters sealed or open), if sent without envelopes, or enclosed in envelopes open at each end, may be forwarded by the inland post, if stamped, at the following rates:—

For a packet not exceeding	4	ounces	(or quarter of a pound)	1 penny
,, ,, ,,	8	,,	(or half a pound)	2 pence.
,, ,, ,,	16	,,	(or one pound)	4 ,,
,, ,, ,,	24	,,	(or one pound and a half)	6 ,,
,, ,, ,,	32	,,	(or two pounds)	8 ,,

[And so on in the proportion of 8 ounces for each additional 2*d.*]

*** Members may obtain on application to the Secretary copies of an Abstract of the Charter and Bye-Laws, of a Statement of the General Objects, &c., of the Society, of Chemical and Veterinary Privileges, and of other printed papers connected with special departments of the Society's business.

Royal Agricultural Society of England.

GENERAL MEETING,

12, Hanover Square, Thursday, May 22, 1862.

REPORT OF THE COUNCIL.

Since the last General Meeting in December, the Council have had to deplore the loss of their President, His Royal Highness the Prince Consort; and, in order to mark their sense of this calamity, they thought it right to present, through the Secretary of State for the Home Department, an address of condolence to Her Majesty the Queen, who has been graciously pleased to accept the same, and to present the Society with a portrait of His Royal Highness, for which the humble and grateful acknowledgments of the Council have been tendered through the President.

The Council have thought it a fitting mark of respect to the memory of their late President to contribute the sum of 100*l.* towards the National Memorial Fund, now in collection, in testimony of the invaluable services rendered by His Royal Highness to the cause of agriculture.

The place named in the last half-yearly Report as fixed for the Country Meeting, to be held in accordance with the provisions of the Royal Charter, has been changed from Windsor to Richmond, in Surrey, and will be held on Saturday, 5th July, at 12 o'clock.

During the past five months 3 Governors and 54 Members have died; and the names of 102 Members have been removed from the list by retirement, or otherwise; while 4 Governors

and 259 Members have been elected, so that the Society now consists of—

83 Life Governors,
97 Annual Governors,
1151 Life Members,
3475 Annual Members, and
17 Honorary Members,

making a total of 4823, being an increase of 104 names on the list.

The Council have elected the Right Hon. Lord Portman President of the Society; Mr. Fisher Hobbs a Vice-President, in the room of the late Earl of Yarborough; and the Right Hon. the Earl of Stradbroke a Member of Council, in the room of the Earl of Powis, elected a Trustee.

The half-yearly statement of accounts, to the 31st December, 1861, has been examined and approved by the auditors and accountants of the Society. The funded capital stands at 17,488*l.* 17*s.* 10*d.* stock in the New Three per Cents.; and the current cash balance in the hands of the bankers on the 1st instant was 4298*l.* 19*s.*

Papers have been read, at the Weekly Meetings, of much interest to the agricultural community—First, on the Agriculture of Russia, communicated by the Imperial Society of Agriculture of Moscow; second, on Cattle Condiments, by Mr. Beale Browne; third, on Steam Boiler Explosions, by Mr. Holland, M.P.; fourth, on the Growth of Mangold Wurzel; fifth, on Preparing, Mixing, and Cooking Food for Cattle, by Mr. Frere; and sixth, on the Present State of Agriculture in Algeria, by Mr. Caird, M.P. A lecture has been delivered by Professor Voelcker on Milk.

The dissemination of the information thus given, by means of the public press, has been attended with much benefit.

Professor Simonds' Report on Rot in Sheep has been published in the form of a pamphlet, and may now be purchased of Mr. Murray. It will be inserted in the next number of the 'Journal.'

The space applied for by the exhibitors of implements having much exceeded the area allotted to that department, it has been found necessary to exclude many articles which have of late

years been exhibited in the Society's Show-Yard, but which had no immediate connection with the purposes of agriculture.

The number of stock entered for competition in almost every class in which prizes have been offered leads the Council to anticipate a very important Show.

It has been determined to erect strong weather-proof horse-boxes, for all the entire horses, in a distinct portion of the Yard, where, at stated periods, they will be led out for exhibition.

The arrangements for giving the Metropolitan Meeting an International character have been much advanced by the assistance received from Her Majesty's Secretary of State for Foreign Affairs, in communicating with the Ministers of Agriculture in foreign countries; and the Council cannot do less than recognise in this public manner his Lordship's cordial co-operation with the objects of the Society.

In compliance with the very generally expressed wish of the Members, the Council have directed a programme of the arrangements connected with the Meeting at Battersea Park to be forwarded to every Member of the Society, who will thus be duly informed of the subjects of interest during the Show.

The collection of wool exhibited by the Society in Class IV. in the International Exhibition will be found to contain specimen fleeces of nearly all the breeds of sheep and their crosses in the United Kingdom, while the various uses to which they are applied by the manufacturer are exemplified in smaller cases. The Council have to thank numerous contributors for the liberal support and assistance received in making this collection.

The Council have decided, subject to the usual conditions, to hold the Society's Country Meeting next year at Worcester.

By Order of the Council,

H. HALL DARE, Secretary.

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

Yearly Cash Account, from 1st January to 31st December, 1861.

	£. s. d.	£. s. d.	£. s. d.
To Balance in hand, 1st Jan. 1861:—			
Bankers	. .	1,236 19 2	
Secretary	. .	41 13 4	
			1,278 12 6
To Income, viz.:—			
Dividend on Stock	. .	424 19 11	
Subscriptions:—			
Governors' Life-Composition .	50 0 0		
Governors' Annual	480 0 0		
Members' Life-Compositions .	399 0 0		
Members' Annual	3,883 17 2		
		4,812 17 2	
Journal:—			
Lord Powis's Prize	50 0 0		
Advertisements	59 9 6		
Sales	242 6 11		
		351 16 5	
			5,589 13 6
To Country Meetings:—			
Canterbury	. .	9 5 0	
Leeds	. .	13,559 16 7	
			13,569 1 7
			£ 20,437 7 7

	£. s. d.	£. s. d.	£. s. d.
By Expenditure:—			
Establishment—			
Official Salaries and Wages . .	654 12 0		
House Expenses, Rent, Taxes, &c.	806 2 10		
		1,460 14 10	
Journal:—			
Printing	903 17 6		
Stitching (3 Numbers)	176 17 8		
Delivery, Advertising, &c. . .	258 17 11		
Prize Essays	140 0 0		
Other Contributions	94 16 0		
Editor's Salary	500 0 0		
		2,074 9 1	
Chemical:—			
Consulting Chemist's Salary (5 quarters)	375 0 0		
Grant for Investigations . . .	200 0 0		
Special Grant for Cheese Investigations	100 0 0		
		675 0 0	
Veterinary:—			
Grant to Royal Veterinary College	200 0 0		
Investigations	46 5 6		
		246 5 6	
Postage and Carriage	. .	46 8 8	
Advertisements	. .	12 10 9	
Sundries	. .	17 12 4	
Subscriptions returned (paid in error)	. .	21 1 0	
			4,557 2 2
By Investment—			
Purchase of Stock, New 3 per Cents.	. .	. .	5,001 1 6
By Country Meetings—			
Canterbury	. .	36 16 0	
Leeds—			
Stock Prizes	1,780 0 0		
Implement Prizes	469 0 0		
General Expenses of Show . .	6,758 12 10		
		9,007 12 10	
			9,044 8 10
Total Payments . . .	. .	. .	18,602 12 6
By Balance in hand, 31st Dec., 1861:—			
Bankers	. .	1,827 19 7	
Secretary	. .	6 15 6	
			1,834 15 1
			£ 20,437 7 7

(Signed) A. N. HOOD, *Chairman of Finance Committee.*
A. H. VERNON.
QUILTER, BALL, JAY, & Co., *Accountants.*

Examined, audited, and found correct, this 16th day of May, 1862.
(Signed) WILLIAM ASTBURY.
HENRY CORBET.

DR. HALF-YEARLY CASH ACCOUNT

	£.	s.	d.	£.	s.	d.	£.	s.	d.
To Balance in hand, 1st July, 1861:—									
Bankers				2,229	13	8			
Secretary				9	3	2			
							2,238	16	10
To Income, viz.:—									
Dividend on Stock				252	9	11			
Subscriptions:—									
Governors' Annual	45	0	0						
Members' Life-Compositions ..	179	0	0						
Members' Annual	877	9	2						
				1,101	9	2			
Journal:—									
Lord Powis's Prize	50	0	0						
Advertisements	31	6	6						
Sales (1 year)	242	6	11						
				323	13	5			
				1,677	12	6			
To Country Meetings:—									
Leeds				10,660	13	7			
							12,338	6	1
							£14,577	2	11

(Signed) A. N. HOOD, *Chairman of Finance Committee.*
A. H. VERNON.
QUILTER, BALL, JAY, & Co., *Accountants.*

BALANCE-SHEET,

LIABILITIES.	£.	s.	d.	£.	s.	d.	£.	s.	d.
To Capital:—									
Surplus, 30th June, 1861				16,674	15	10			
Less Surplus of Expenditure over Income during the Half-year, viz:—									
Expenditure	2,275	18	10						
Income	1,682	12	6						
				593	6	4			
							16,081	9	6
To Balance at Credit of Leeds Meeting				..	..		4,551	1	8
							£20,632	11	2

FROM 1ST JULY TO 31ST DECEMBER, 1861. Cr.

	£. s. d.	£. s. d.	£. s. d.
By Expenditure:—			
Establishment—			
Official Salaries and Wages ..	327 6 0		
House Expenses, Rent, Taxes, &c.	485 4 3		
		812 10 3	
Journal:—			
Printing	448 14 0		
Stitching (2 Numbers)	116 3 5		
Delivery, Advertising, &c. ..	141 6 11		
Prize Essays	130 0 0		
Other Contributions	68 1 0		
Editor's Salary	250 0 0		
		1,154 5 4	
Chemical:—			
Consulting Chemist's Salary		150 0 0	
Veterinary:—			
Grant to Royal Veterinary College	100 0 0		
Investigations	13 1 0		
		113 1 0	
Postage and Carriage		16 3 9	
Advertisements		2 4 9	
Sundries		6 13 9	
Subscriptions returned (paid in error)		21 0 0	
			2,275 18 10
By Investment—			
Purchase of Stock, New 3 per Cents.		.. ..	3,000 0 0
By Country Meetings—			
Canterbury		1 5 0	
Leeds:—			
Stock Prizes	1,780 0 0		
Implement Prizes	469 0 0		
Other Payments	5,216 4 0		
		7,465 4 0	
			7,466 9 0
Total Payments		.. ..	12,742 7 10
By Balance in hand:—			
Bankers		1,827 19 7	
Secretary		6 15 6	
			1,834 15 1
			£14,577 2 11

Examined, audited, and found correct, this 16th day of May, 1862.

(Signed) WILLIAM ASTBURY.
HENRY CORBET.

31ST DECEMBER, 1861.

ASSETS.	£. s. d.	£. s. d.
By Cash in hand	.. ..	1,834 15 1
By New 3 per cent. Stock 17,488*l.* 17*s.* 10*d.* cost ..	.. ..	16,797 16 1
By Books and Furniture, Society's House, Hanover Square	.. ..	2,000 0 0
Mem.—The above Assets are exclusive of the amount recoverable in respect of Subscriptions in arrear 31st December, 1861, which at that date amounted to 716*l.*		£20,632 11 2

SHOW IN BATTERSEA PARK, LONDON, JUNE, 1862.

STEWARDS OF THE YARD.

Stewards of Live Stock.
Hon. W. Cavendish, M.P.
Thomas Pain.
Richard Milward.

Steward of Foreign Live Stock.
W. Fisher Hobbs.

Hon. Assistant Steward of Foreign Live Stock.
M. de la Trehonnais.

Stewards of Implements.
Lord Leigh.
Hon. Augustus Vernon.
William Torr.
Chandos Wren Hoskyns.

Honorary Director of the Show.
B. T. Brandreth Gibbs.

JUDGES.

Short-horns (Male).
W. Cattle,
F. Fowler,
W. Tindall.

Short-horns (Female).
T. Parkinson,
J. Gamble.
W. F. D. Dickinson.

Herefords.
E. L. Franklin,
R. Moggridge,
S. Bloxsidge.

Devon and Sussex.
R. B. Warren,
H. W. Keary,
S. Umbers.

All other Breeds.
A. Denman,
R. Smith,
J. E. Jones,
Col. Le Couteur, additional Judge of Channel Island Entries.

Thorough-bred Horses and Hunters.
Lord Tredegar,
Colonel Cotton,
Captain White.

Carriage Horses, Roadsters, and Ponies.
H. Thurnall,
R. S. Waters,
J. E. Welby.

Agricultural Horses (Suffolk).
E. Green,
W. S. Atkinson,
W. C. Spooner.

Other Agricultural Horses.
James Boote,
J. H. Bland,
J. H. Wood.

Leicesters.
G. Leighton,
J. W. Mann,
R. Woods.

Lincolns, and other Long-wools.
H. Beevor,
L. Borman,
B. Nicholson.

Cotswolds.
J. Marriot,
W. S. Stevens.

Southdowns.
E. Trumper,
G. Harding,
S. Field.

Shropshire Downs.
G. Cureton,
J. Rawlence,
H. Fookes.

Hampshire Downs and Short-wools.
E. Little,
E. P. Squarey,
J. Blundell.

Judge for Mountain Sheep.
J. Patterson.

Oxfordshires.
E. Ruck,
T. Harris,
C. W. Thacker.

Pigs.
Major H. S. M'Clintock.
J. S. Turner.
J. Woolf.

SCOTCH JUDGES.

Polled Cattle.
J. GRAHAM,
H. WATSON,
W. SMITH.

Highland Cattle.
R. D. CAMPBELL,
J. MACFARLANE.

Ayrshire Cattle.
P. G. BARNES,
R. GUTHRIE,
J. MURDOCH.

Clydesdale Horses.
A. RENWICK,
R. FINDLAY.

Black-Faced Sheep.
J. MACFARLANE.
R. PATERSON.

Cheviot Sheep.
R. PATERSON,
W. AITCHISON.

FOREIGN JUDGES.

French Cattle.
M. ST. MARIE,
SIR E. KERRISON, BART.

French Sheep.
M. LE FOUR,
EDWARD POPE.

French Horses and French Pigs.
BARON BILLING,
SIR E. KERRISON, BART.

Dutch Cattle.
M. ST. MARIE.
SIR E. KERRISON, BART.,

Swiss Cattle.
M. GEMSCH,
M. KARLEN,
SIR A. K. MACDONALD, BART.

Saxony Sheep.
M. K. A. RITTNER.
EDWARD POPE,

Veterinary-Inspectors.
PROFESSOR SIMONDS,
PROFESSOR SPOONER.
(Royal Veterinary College.)

Consulting-Engineer.
CHARLES EDWARDS AMOS,
(Firm of EASTON, AMOS and SONS).

AWARD OF PRIZES.

NOTE.—The Judges are instructed to give in a *Reserved Number* to one animal in each Class, viz., the animal which would in their opinion possess sufficient merit for the Prize, in case an animal to which a Prize is awarded should subsequently become disqualified.

CATTLE.

Short-horn Bulls.

JOHN WOOD, Stanwick Park, Darlington: First Prize, 30*l.*, for his 3 years 3 months and 4 days-old "Lord Adolphus," white; bred by himself; sire, "Cardigan" (12,556); dam, "Lady Annabella."

JAMES HAUGHTON LANGSTON, M.P., Sarsden House, Chipping Norton, Oxon: Second Prize, 15*l.*, for his 3 years 7 months and 22 days-old "Lord of the Harem" (16,430), roan; bred by Mr. Housman, Lime Bank, Lancaster; sire, "Duke of Buckingham" (14,428); dam, "Gulnare."

WILLIAM HOSKEN AND SON, Loggans Mill, Hayle, Cornwall: Third Prize, 5*l.*, for their 4 years 5 months and 6 days-old "Prince Frederick" (16,734), roan; bred by Mr. Langston, M.P.; sire, "Gloster's Grand Duke" (12,949); dam, "Champion."

JAMES DICKINSON, Balcony Farm, Upholland, Wigan, Lancaster: the *Reserved Number*, to his 3 years 6 months and 20 days-old "Duke of Holland" (17,716), red and white; bred by himself; sire, "Pope's Eye" (15,071); dam, "Amelia."

WILLIAM STIRLING, M.P., Keir, Dunblane, Perth: First Prize, 30*l.*, for his 2 years 5 months and 1 week-old "Forth," roan; bred by himself; sire, "Florist" (16,064); dam, "Anna Rose."

HENRY AMBLER, Watkinson Hall, Halifax, Yorkshire: Second Prize, 15*l.*, for for his 2 years 5 months and 26 days-old "Gamester," white; bred by H. W. Ripley, Lightcliffe, Halifax; sire, "Prince Talleyrand" (16,765); dam, "Griselda."

ARTHUR JAMES BALFOUR, Whittingham, Prestonkirk, Haddingtonshire: Third Prize, 5*l.*, for his 2 years and 4½ months-old "Great Seal," red; bred by C. Smith and Co., Hillhead, Nairn, Inverness; sire, "Lord Privy Seal" (16,444); dam, "Jenny Groat."

THE DUKE OF MONTROSE, Buchanan, Glasgow: the *Reserved Number*, to his 2 years 11 months and 1-week-old "Victor Royal," red; bred by himself; sire, "Victor Emmanuel" (15,460); dam, "Victoria 27th."

STEWART MARJORIBANKS, Bushey Grove, Watford, Herts: First Prize, 25*l.*, for his 1 year and 6 months-old "Whipper-in" (19,139), roan; bred by himself; sire, "Cock of the Walk" (15,782); dam, "Annie."

LIEUTENANT-COLONEL TOWNELEY, Towneley Park, Burnley, Lancashire: Second Prize, 15*l.*, for his 1 year 8 months and 25 days-old "Royal Butterfly 10th," red and white; bred by himself; sire, "Royal Butterfly;" dam, "Parade."

HENRY AMBLER: Third Prize, 5*l.*, for his 1 year 8 months and 2 days-old "Windsor Augustus," roan; bred by William Carr, of Stackhouse, Settle, Yorkshire; sire, "Windsor" (14,013); dam, "Lady Flora."

HENRY AMBLER: the *Reserved Number*, to his 1 year 10 months and 18 days-old "Rifle Prince," roan; bred by himself; sire, "Prince Talleyrand" (16,765); dam, "Actress."

JONAS WEBB, Babraham, Cambridge: the GOLD MEDAL, and First Prize, 15*l.*, for his 10 months and 18 days-old "First Fruit," white; bred by himself; sire, "Englishman;" dam, "Welfare."

THOMAS EDWARD PAWLETT, Beeston, Sandy, Beds: Second Prize, 10*l.*, for his 11 months and 19 days-old "Hopewell," roan; bred by himself; sire, "Sheet Anchor" (18,820); dam, "May Dew."

JOSEPH ROBINSON, Clifton Pastures, Newport Pagnell, Bucks: Third Prize, 5*l.*, for his 9 months and 27 days-old "Jericho," rich roan; bred by himself; sire, "Hayman" (16,245); dam, "Jenny Cambridge."

JOSEPH ROBINSON: the *Reserved Number*, to his 9 months and 20 days-old "Composite," red; bred by himself; sire, "Duke of Leinster" (17,724); dam, "Graceful."

Short-Horn Cows and Heifers.

RICHARD BOOTH, Warlaby, Northallerton, Yorkshire: the GOLD MEDAL, and First Prize, 20*l.*, for his 3 years 7 months and 25 days-old "Queen of the Ocean," red and white; bred by himself; sire, "Crown Prince" (10,087); dam, "Red Rose."

LADY PIGOT, Branches Park, Newmarket, Suffolk: Second Prize, 10*l.*, for her 3 years 5 months and 26 days-old "Pride of Southwick," light roan, in-calf; bred by Mr. Stewart, of Southwick, Dumfries; sire, "Mac Turk" (14,872); dam, "Vanity."

JONAS WEBB: Third Prize, 5*l.*, for his 3 years 5 months and 13 days-old "Lady Elizabeth Yorke," roan; bred by himself; sire, "Thorndale" (17,123); dam, "Countess of Hardwick."

HENRY AMBLER: the *Reserved Number*, to his 4 years 1 month and 12 days-old "Wood Rose," dark roan, in-milk; bred by himself; sire, "Heart of Oak" (14,683); dam, "Woodbine."

THE DUKE OF MONTROSE: First Prize, 15*l.*, for his 2 years and 2 months-old, "May Morn," white, in-calf; bred by himself; sire, "Victor Emmanuel" (15,460); dam, "New-Year's Morn."

JOHN LANE, Barton Mills, Cirencester, Gloucestershire: Second Prize, 10*l.*, for his 2 years 4 months and 8 days-old "Maid of Athens," white, in-calf: bred by himself; sire, "Sir Richard" (15,298) dam, "Miss Bloomer."

LORD FEVERSHAM, Duncombe Park, Helmsley, Yorkshire: Third Prize, 5*l.*, for his 2 years 7 months and 24 days-old "Cecilia," roan, in-calf; bred by himself; sire, "Charming Lad;" dam, "Choice."

JAMES DOUGLAS, Athelstaneford Farm, Drem, Haddingtonshire: the *Reserved Number*, to his 2 years 2 months and 2 days-old, "Queen of Athelstane," red, in-calf; bred by himself; sire, "Sir James the Rose" (15,290); dam, "Playful."

RICHARD BOOTH: First Prize, 15*l.*, for his 1 year 5 months and 3 weeks-old "Queen of the May 2nd," roan; bred by himself; sire, "Windsor" (14,013), or "Sir Samuel" (15,302); dam, "Queen of the Vale."

LIEUTENANT-COLONEL TOWNELEY: Second Prize, 10*l.*, for his 1 year 11 months and 2 days-old "Frederick's Faithful," roan; bred by himself; sire, "Frederick; dam, "Vestris 3rd."

Lord Feversham: Third Prize, 5*l*., for his 1 year 6 months and 25 days-old "Barefoot," red; bred by himself; sire, "Chanticleer;" dam, "Ballad-singer."

Thomas Atherton, Chapel House, Speke, Garston, Lancashire: the *Reserved Number*, to his 1 year 10 months and 2 weeks-old "Lady Barrington 6th," red; bred by himself; sire, "2nd Duke of Cambridge" (12,743); dam, "Lady Barrington 4th."

J. R. Middlebrough, South Milford, Yorkshire: First Prize, 15*l*., for his 11 months and 6 days-old "Lady," roan; bred by himself; sire, "Lord Clyde;" dam, "Royal Daisy."

James Douglas: Second Prize, 10*l*., for his 11 months and 25 days-old "Pride of Athelstane," red and white; bred by himself; sire, "Sir James the Rose" (15,290); dam, "Lady of Athelstane."

Joseph Robinson: Third Prize, 5*l*., for his 8 months and 27 days-old "Claret Cup," roan; bred by himself; sire, "Duke of Leinster" (17,724); dam, "Claret."

Lady Pigot: the *Reserved Number*, to her 10 months and 19 days-old "Castianira," light roan; bred by herself; sire, "Lord of the Valley" (14,837); dam, "Castanet."

Hereford Bulls.

The Hon. Colonel Hood, Cumberland Lodge, Windsor Park: First Prize, 30*l*., for his 3 years 11 months and 18 days-old "Maximus" (1650), red and white; bred at His Royal Highness the Prince Consort's Flemish Farm, Windsor; sire, "Brecon" (918); dam, "Superb."

Thomas Davis, Burlton Court, Hereford: Second Prize, 15*l*., for his 5 years 9 months and 3 weeks-old "Courtier," red; bred by Edward Price, of Court House, Pembridge, Herefordshire; sire, "Goldfinder 2nd;" dam, "Lovely."

John Naylor, Leighton Hall, Welshpool, Montgomeryshire: Third Prize, 5*l*., for his 4 years and 11 months-old "Salisbury," red, with white face; bred by William Perry, of Cholstrey, Leominster, Herefordshire; sire, "Monkland 3rd" (1013); dam, "Pigeon" (198).

Charles Vevers, Ivington Park, Leominster: the *Reserved Number*, to his 3 years 11 months and 19 days-old "Stratagem 3rd," red, with white face; bred by himself; sire, "Croft" (937); dam, "Pigeon."

Richard Hill, Golding Hall, Shrewsbury: the Gold Medal, and First Prize, 30*l*., for his 2 years 10 months and 25 days-old "Milton," red, with white face; bred by himself; sire, "Chanticleer;" dam, "Jenny Lind."

R. Harcourt Capper, the Northgate, Ross, Herefordshire: Second Prize, 15*l*., for his 2 years 11 months and 5 days-old "Lord Wellington," red, with white face; bred by William Perry, St. Oswald, Cholstrey, Leominster; sire, "Noble Boy" (1337); dam, "Silver 2nd."

Thomas Duckham, Baysham Court, Ross, Herefordshire: Third Prize, 5*l*., for his 2 years and 15 days-old "Victor," red, with white face; bred by himself; sire, "Cronkhill" (1558); dam, "Winfred."

Thomas Roberts, Ivington Bury, Leominster: the *Reserved Number*, to his 2 years 5 months and 24 days-old "Sir Thomas," red, with white face; bred by himself; sire, "Sir Benjamin."

James Taylor, Stretford Court, Leominster: First Prize, 25*l*., for his 1 year 11 months and 11 days-old "Unity," red and white; bred by himself; sire, "St. Oswall" (1378); dam, "Strawberry 3rd."

John Naylor: Second Prize, 15*l.*, for his 1 year 11 months and 2 weeks-old "Blondin," red, with white face; bred by himself; sire, "Admiral" (1481); dam, "Delight."

William Taylor, Showle Court, Ledbury, Hereford: Third Prize, 5*l.*, for his 1 year 10 months and 2 weeks-old "Tamberine," red, with white face; bred by Lord Bateman, of Shobdon Court, Leominster; sire, "Carlisle" (923); dam, "Little Beauty."

Thomas Thomas, St. Hilary, Cowbridge, Glamorganshire: the *Reserved Number*, to his 1 year and 6 months-old "Victory," red, with white face; bred by himself; sire, "Goldfinder 2nd;" dam, "Fair Maid."

Charles Vevers: First Prize, 15*l.*, for his 11 months and 15 days-old "Battersea," red, with white face; bred by himself; sire, "Corn Exchange;" dam, "Pigeon."

Philip Turner, The Leen, Pembridge, Leominster: Second Prize, 10*l.*, for his 11 months and 1 week-old "Percy," red, with white face; bred by himself; sire, "Logic;" dam, "Comely."

William Tudge, Adforton, Leintwardine, Herefordshire: Third Prize, 5*l.*, for his 10 months and 10 days-old "Adforton;" bred by himself; sire, "The Grove" (1764); dam, "Dainty."

Thomas Roberts: the *Reserved Number*, to his 11 months and 20 days-old "Royal Butterfly," red, with white face; bred by himself; sire, "Master Butterfly" (1313); dam, "Duchess."

Hereford Cows and Heifers.

Henry Coate, Sherborne, Dorset: the Gold Medal, and First Prize, 20*l.*, for his 6 years 5 months and 25 days-old "Matchless," red and white; bred by himself; sire, "Young Protection;" dam, "Mystery."

George Pitt, Chadnor Court, Dilwyn, Leominster: Second Prize, 10*l.*, for his 6 years 4 months and 11 days-old "Perfection," red, with white face; bred by himself; sire, "Plunder" (1038); dam, "Brandy."

R. Harcourt Capper, the Northgate, near Ross, Herefordshire: Third Prize, 5*l.*, for his 5 years 11 months and 20 days-old "Ada," red, with white face; bred by the late Lord Berwick, of Cronkhill, Shrewsbury; sire, Attingham (911); dam, "Silver."

John E. Hewer, Vern House, Hereford: the *Reserved Number*, to his 6 years 11 months and 5 days-old "Beauty," red, with white face; bred by the late Lord Berwick; sire, "Attingham;" dam, "Silver."

James Marsh Read, Elkstone, Cheltenham, Gloucestershire: First Prize, 15*l.*, for his 2 years 8 months and 16 days-old "Theora," red, with white face, in-calf; bred by himself; sire, "Sebastopol" (1381); dam, "Cherry 7th."

William Tudge: Second Prize, 10*l.*, for his 2 years 9 months and 22 days-old "Butterfly," red, with white face and mane, in-calf; bred by himself; sire, "The Doctor" (1083); dam, "Red Rose."

Henry Rawlings Evans, Jun., Swanstone Court, Dilwyn, Leominster: Third Prize, 5*l.*, for his 2 years 10 months and 3 days-old "Sylph," red, with white face, in-calf; bred by himself; sire, "Rambler" (1046); dam, "Silk."

James Rea, Monaughty, Knighton, Radnorshire: the *Reserved Number*, to his 2 years 10 months and 17 days-old "Diana 2nd," red, with white face and mane, in-calf; bred by himself; sire, "Wellington" (1112); dam, "Diana."

The Hon. Colonel Hood: First Prize, 15*l.*, for his 1 year 6 months and 19 days-old "Adela," red and white, from the Flemish Farm, Windsor, bred by the late Lord Berwick; sire, "Will-o'the-Wisp" (1454); dam, "Agnes."

John Naylor: Second Prize, 10*l.*, for his 1 year 10 months and 3 weeks-old "Heiress," red, with white face; bred by the late Lord Berwick; sire, "Severn" (1382); dam, "Young Vic."

Thomas Thomas: Third Prize, 5*l.*, for his 1 year 5 months and 3 weeks-old "Laura," red, with white face; bred by himself; sire, "Goldfinder 2nd;" dam, "Fancy."

John Williams: St. Mary's, Kingsland, Leominster: the *Reserved Number*, to his 1 year 10 months and 11 days-old "Duchess," red, with white face; bred by himself; sire, "Van Tromp;" dam, "Red Rose."

John Baldwin, Luddington, Stratford-on-Avon, Warwickshire: First Prize 15*l.*, for his 8 months and 8 days-old "Adelina," red and white; bred by himself; sire, "Severn;" dam, "Agnes."

James Marsh Read: Second Prize, 10*l.*, for his 10 months and 24 days-old "Miss Southam," red, with white face; bred by himself; sire, "Caliban" (1163); dam, "Cherry 7th."

William Perry: St. Oswalds, Cholstrey, Leominster: Third Prize, 5*l.*, for his 11 months and 22 days-old red and white; bred by himself; sire, "Lord Nelson;" dam, "Pretty Maid."

Edmund Wright, Halston Hall, Oswestry, Salop: the *Reserved Number*, to his 11 months and 3 weeks-old "Primrose," red, with white face; bred by himself; sire, "Hector;" dam, "Winsome."

Devon Bulls.

James Davy, Flitton Barton, North Molton, Devonshire: the Gold Medal, and First Prize, 30*l.*, for his 3 years 1 month and 17 days-old "Duke of Flitton," red; bred by himself; sire, "Quartly's Napoleon;" dam, "Lady Bess."

Samuel Pomeroy Newbery, Scruel Barton, Honiton, Devon: Second Prize. 15*l.*, for his 3 years 2 months and 5 days-old "Bonaparte," red; bred by himself; sire, "Quartly's Napoleon;" dam, "Lovely."

T. and J. Palmer, Norton Stoke Clinsland, Callington, Cornwall: Third Prize, 5*l*, for his 3 years 6 months and 5 days-old "Lord Cary," brown; bred by James Quartly, of Molland House, South Molton, Devon; sire, "Napoleon;" dam, "Primrose."

The Hon. Colonel Hood: the *Reserved Number*, to his 4 years 9 months and 18 days-old "Colonel," red; bred at H.R.H. the Prince Consort's Norfolk Farm, Windsor; sire, "Zouave" (556); dam, "Rosa."

Walter Farthing, Stowey Court, Bridgewater, Somerset: First Prize, 30*l.*, for his 2 years 7 months and 2 weeks-old "Viscount," red; bred by himself; sire, "Sir Peregrine;" dam, "Molly."

John Bodley, Stockley Pomeroy, Crediton, Devon: Second Prize, 15*l.*, for his 2 years 7 months and 1 week-old "Champion," red; bred by Mr. James Quartly; sire, "Napoleon" (259); dam, "Dolly Varden" (142).

William Herbert Wodehouse, Woolmers Park, Hertfordshire: Third Prize, 5*l.*, for his 2 years 6 months and 19 days-old "Zemindar," red; bred by William Hole, Hannaford, Barnstaple, Devon; sire, "Zeluco" (554); dam "Juno" (1423).

James Davy: the *Reserved Number*, for his 2 years and 2 weeks-old "Garibaldi," red; bred by himself; sire, "Palmerston;" dam, "Eclipse."

The Hon. Colonel Hood: First Prize, 25*l.*, for his 1 year 7 months and 18 days-old "Crown Prince," red; bred at H.R.H. the Prince Consort's Norfolk Farm, Windsor; sire, "Napoleon" (259); dam, "Peace and Plenty" (935).

JAMES MERSON, Brinsworthy, North Molton, Devon: Second Prize, 15*l.*, for his 1 year 7 months and 18 days-old "Fusileer," red; bred by William Hole; sire, "Comet;" dam, "Laura" (256).

WALTER FARTHING: Third Prize, 5*l.*, for his 1 year and 6 months-old, red; bred by himself; sire, "Sir Peregrine;" dam, "Picture."

THE HON. COLONEL HOOD: First Prize, 15*l.*, for his 10 months and 28 days-old "Prince Alfred," red; bred at H.R.H. the Prince Consort's Norfolk Farm, Windsor; sire, "Colonel" (387); dam, "Fancy" (703).

GEORGE TURNER, Beacon Downes, Exeter, Devon: Second Prize, 10*l.*, for his 6 months and 3 weeks-old, red; bred by himself; sire, "The Little Known;" dam, "Bountiful."

GEORGE TURNER: Third Prize, 5*l.*, for his 6 months and 10 days-old, red; bred by himself; sire, "The Little Known;" dam, "Piccolomini."

WALTER FARTHING: the *Reserved Number*, to his 6 months and 2 days-old, red; bred by himself; sire, "Sir Peregrine;" dam, "Cherry."

Devon Cows and Heifers.

JAMES DAVY: the GOLD MEDAL and First Prize, 20*l.*, for his 6 years 1 month and 11 days-old "Temptress," red, in-calf and in-milk; bred by himself; sire, "Davy's Napoleon;" dam, "Pink."

GEORGE TURNER: Second Prize, 10*l.*, for his 7 years 5 months and 2 weeks-old "Piccolomini," red; bred by himself; sire, "Duke of Devon;" dam, "Mayflower."

JOHN AZARIAH SMITH, Bradford Peverill, Dorchester: Third Prize, 5*l.*, for his 3 years 7 months and 4 days-old "Rachel," red; bred by Lord Portman, Bryanston House, Blandford, Dorset; sire, "Palmerston" (476); dam, "Rachel."

GEORGE TURNER: the *Reserved Number*, to his 5 years 7 months and 3 days-old "Vaudine," red; bred by himself; sire, "Palmerston;" dam, "Wallflower."

WILLIAM PAULL, Piddletown, Dorchester: First Prize, 15*l.*, for his 2 years 9 months and 23 days-old "Young Hebe," red, in-calf; bred by Lord Portman; sire, "Davy's Napoleon 3rd" (464); dam, "Hebe" (220).

JAMES MERSON: Second Prize, 10*l.*, for his 2 years 11 months and 11 days-old "Profit," red, in-calf; bred by himself; sire, "Prince of Wales;" dam, "Young Cherry."

JAMES MERSON: Third Prize, 5*l.*, for his 2 years 10 months and 8 days-old "Favourite," light red, in-calf; bred by himself; sire, "Prince of Wales;" dam, "Young Pink."

WILLIAM PAULL, the *Reserved Number*, to his 2 years 8 months and 29 days-old "Young Goldcup," red, in-calf; bred by Lord Portman; sire, "Palmerston" (476); dam, "Goldcup."

JAMES DAVY: First Prize, 15*l.*, for his 6 months and 1 week-old, "Lady Fortune," red; bred by himself; sire, "Prince Alfred;" dam, "Symmetry."

SIR ALEXANDER ACLAND HOOD, St. Audries, Bridgwater, Somerset: Second Prize, 10*l.*, for his 7 months and 19 days-old, dark red; bred by himself; sire, "Sir Peregrine;" dam, "Daisy."

SIR ALEXANDER ACLAND HOOD: Third Prize, 5*l.*, for his 8 months and 11 days-old, dark red; bred by himself; sire, "Sir Peregrine;" dam, "Queen."

George Turner: the *Reserved Number*, to his 6 months and 3 days-old "Lurline," red; bred by himself; sire, "The Little Known;" dam, "Vaudine."

James Davy: First Prize, 15*l.*, for his 1 year 6 months and 2 weeks-old "Princess Alice," red; bred by himself; sire, "Duke of Flitton;" dam, "Princess of Prussia."

James Davy: Second Prize, 10*l.*, for his 1 year and 1 month-old "Young Empress," red; bred by himself; sire, "Prince Alfred;" dam, "Empress."

James Merson: Third Prize, 5*l.*, for his 1 year 8 months and 5 days-old "Beauty," red; bred by himself; sire, "Davy's Napoleon 3rd;" dam, "Lovely."

William Hole, Hannaford, Barnstaple, Devon: the *Reserved Number*, to his 1 year 8 months and 11 days-old, "Isis," red; bred by himself; sire, "Comet;" dam, "Io" (1409).

Sussex Bulls.

William Botting, Westmeston Place, Hurstpierpoint, Sussex: First Prize, 15*l.*, for his 4 years and 8 days-old "Midsummer," red; bred by himself; sire, "Viceroy;" dam, "Myrtle 6th."

George Jenner, Parsonage House, Udimore, Rye, Sussex: Second Prize, 5*l.*, for his 4 years 6 months and 2 days-old "Challenger," red; bred by Henry Noakes, of Benden Farm, Mayfield, Sussex; dam, "Old Beauty."

William Botting: the *Reserved Number*, to his 5 years 3 months and 20 days-old "Baron," red; bred by himself; sire, "Myrtle;" dam, "Old Beauty."

John and Alfred Heasman, Angmering, Arundel, Sussex: First Prize, 10*l.*, for their 1 year 6 months and 1 week-old, "The Duke," red; bred by themselves; sire, "Marquis" (16); dam, "Buttercup" (297).

William Marshall, Bolney Place, Cuckfield, Sussex: Second Prize, 5*l.*, for his 2 years 6 months and 24 days-old, "Prince Alfred;" bred by W. Tollands, Buckshaw, Lindfield, Sussex.

Edward Cane, Berwick Court, Lewes, Sussex: the *Reserved Number*, to his 1 year 5 months and 5 days-old "Prime Minister," brown; bred by himself; sire, "Southwestern" (43); dam, "Pera" (84).

Sussex Cows and Heifers.

Richard Woodman, Glynde, Lewes, Sussex: First Prize, 10*l.*, for his about 9 years-old, red; bred by Thomas Jenner, of Ripe, Hurst Green, Sussex.

Tilden Smith, Knelle, Beckley, Staplehurst, Sussex: Second Prize, 5*l.*, for his 3 years 6 months and 5 days-old "Beauty;" bred by himself; sire, "Knell Bull."

George Jenner: the *Reserved Number*, to his 5 years and 5 months-old "Tank," red; bred by himself; sire, Mr. Stonham's bull "Beckley."

John and Alfred Heasman: First Prize, 10*l.*, for their 2 years 5 months and 2 weeks-old "Lily," red, in-calf; bred by themselves; sire, "Marquis" (16); dam, "Snowdrop" (265).

George Jenner: Second Prize, 5*l.*, for his 2 years 5 months and 17 days-old "Bishopp," red, in-calf; bred by himself; sire, "Challenger;" dam, "Bishopp."

George Jenner: the *Reserved Number*, to his 2 years and 5 months-old, "Crumple Horn," red, in-calf; bred by himself; sire, "Challenger;" dam, "Crumple Horn."

Long-horn Bulls.

LIEUTENANT-COLONEL WILLIAM INGE, Thorpe Constantine, Tamworth, Staffordshire: First Prize, 15*l.*, for his 4 years 6 months and 20 days-old "Tom" (L 8), brindled and white; bred by himself; sire, "Duke" (D 4); dam, "Treasure" (L 2).

WILLIAM THOMAS COX, The Hall, Spondon, Derby: Second Prize, 5*l.*, for his 3 years 5 months and 11 days-old "Isaac," brindle; bred by himself; sire, "Conqueror;" dam, "Beauty."

JAMES DAVIS, Melcombe Horsey, Dorchester, Dorset: First Prize, 10*l.*, for his 1 year and 3 months-old; bred by Joseph Holland Burbery, The Chase, Kenilworth, Warwick.

EDWARD THORNTON TWYCROSS, Canley, Coventry, Warwickshire: Second Prize, 5*l.*, for his 1 year 3 months and 17 days-old, brindle and white; bred by himself.

WILLIAM THOMAS COX: the *Reserved Number*, to his 1 year and 11 days-old "Charlie," brindle; bred by himself; sire, "Isaac;" dam, "Lovely."

Long-horn Cows and Heifers.

RICHARD WARNER, Weston Hill, Nuneaton, Warwickshire: First Prize, 10*l.*, for his 7 years 3 months and 24 days-old "Lupin," red and white; bred by himself.

LIEUTENANT-COLONEL WILLIAM INGE: Second Prize, 5*l.*, for his about 9 years-old "Fillpail" (F Y 1), brindled and white; bred by Mrs. Baker, of Barton-on-the-Heath, Shipston-on-Stour, Warwickshire.

EDWARD THORNTON TWYCROSS: the *Reserved Number*, to his 10 years and 2 months-old, red and white; bred by himself.

RICHARD HEMMING CHAPMAN, Upton, Nuneaton, Warwick: First Prize, 10*l.*, for his 2 years 3 months and 2 weeks-old "Young Cumberland," white and brindled, in-calf; bred by himself; sire, "Lord Western;" dam, "Cumberland."

JOSEPH HOLLAND BURBERY, The Chase, Kenilworth, Warwickshire: First Prize, 10*l.*, for his 1 year 2 months and 3 weeks-old; bred by himself.

JOSEPH HOLLAND BURBERY: Second Prize, 5*l.*, for his 1 year 3 months and 3 weeks-old; bred by himself.

RICHARD HEMMING CHAPMAN: the *Reserved Number*, to his 1 year 1 month and 2 weeks-old "Lady Nugent," white and brindled; bred by himself; sire, "Lord Warner;" dam, "Wroxall."

Norfolk and Suffolk Polled Bulls.

SIR EDWARD KERRISON, Bart., M.P., Brome Hall, Scole, Suffolk: First Prize, 15*l.*, for his 4 years and about 3 months-old "Bowbearer," red; bred by J. Moseley, Great Glemham Hall, Framlingham, Suffolk; sire, "Bullfice;" dam, "Grimwade."

JOHN SMITH, Crownthorpe, Wymondham, Norfolk: Second Prize, 5*l.*, for his 4 years 2 months and 3 weeks-old "Redjacket 2nd," red; bred by himself; sire, "Redjacket."

LORD SONDES, Elmham Hall, Thetford, Norfolk: the *Reserved Number*, to his 3 years and 8 months-old "Tom Thurnall," red; bred by himself.

SAMUEL WOLTON, Newbourn Hall, Woodbridge, Suffolk: First Prize, 10*l.*, for his 1 year 4 months and 4 days-old "Eclipse," red; bred by himself; sire, "Nonpareil;" dam, "Cossell."

Arthur William Crisp, Chillesford, Wickham Market, Suffolk: Second Prize, 5*l.*, for his 2 years 2 months and 1 week-old "Duke," red; bred by himself; sire, "Volunteer;" dam, "Moss Rose."

Lord Sondes: the *Reserved Number*, to his 1 year and 8 months-old "Rufus," red; bred by Thomas W. George, of Eaton, Norwich.

Norfolk and Suffolk Polled Cows and Heifers.

Sir Edward Kerrison, Bart., M.P.: First Prize, 10*l.*, for his about 9 years-old "Duchess of Norfolk," dark red; bred by R. J. Oliver, Docking, Lynn, Norfolk; sire, "Ruby;" dam, "Beauty."

Sir Willoughby Jones, Bart., Cranmer Hall, Fakenham, Norfolk: Second Prize, 5*l.*, for his 3 years 5 months and 17 days-old "Hetty," red; bred by Lord Sondes.

Lord Sondes: the *Reserved Number*, to his about 5 years-old "Crocus," red; bred by Robert Tash, of Shipdham, Thetford, Norfolk.

Lord Sondes: First Prize, 10*l.*, for his 2 years and 4 months-old "Coral," red, in-calf; bred by himself.

Lord Sondes: Second Prize, 5*l.*, for his 2 years and 6 months-old "Ruby," red, in-calf; bred by himself.

Samuel Wolton, Newbourn Hall, Woodbridge, Suffolk: the *Reserved Number*, for his 2 years 4 months and 16 days-old "Favourite," red, in-calf; bred by himself; sire, "Red Robin;" dam, "Cosselt."

Lord Sondes: First Prize, 10*l.*, for his 1 year and 3 months-old "Cherry," red; bred by himself.

Sir Edward Kerrison, Bart., M.P.: Second Prize, 5*l.*, for his 1 year and 11 months-old "Plover the 2nd," red; bred by himself; sire, "Bow-bearer;" dam, "Plover."

North Wales Cows.

Richard Hart Harvey, Harroldstone, Haverfordwest, Pembrokeshire: First Prize, 10*l.*, for his 6 years and 2 months-old "Maud," black (Anglesea); bred by R. Rowlands, Plaspenmynydd, Llangefni, Anglesea.

Richard Hart Harvey: Second Prize, 5*l.*, for his 7 years and 2 months-old, "Gwendoline," black (Anglesea); bred by Edward Richards, of Ynis, Llanerchymedd, Anglesea.

South Wales Bull.

George Brown, Talbenny Hall, Haverfordwest: First Prize, 10*l.*, for his 2 years and 8 months-old "Pembroke," black (Castlemartin); bred by James Parcell, Lydstep, Tenby, Pembroke.

South Wales Cows and Heifers.

Clare Sewell Read, Plumstead House, Norwich, Norfolk: First Prize, 10*l.*, for his about 8 years and 7 months-old "Lovely," black; bred by John Lock, Rowston, Pembroke.

Clare Sewell Read: Second Prize, 5*l.*, for his about 11 years and 6 months-old "Lucky," black; bred by W. B. Roberts Loveston, Pembroke.

Richard Hart Harvey: the *Reserved Number*, to his 6 years and 2 months-old "Countess," black (Castlemartin); bred by J. Thomas, Bullibee Farm, Pembroke.

Richard Hart Harvey: First Prize, 10*l.*, for his 2 years and 11 months-old, "Polly," black (Castlemartin), in-calf; bred by James Parcell, Lydstep, Tenby, Pembroke.

Clare Sewell Read: Second Prize, 5*l.*, for his about 2 years and 3 months-old, black, in-calf; bred by George Gwither, Hoplas, Pembroke.

Clare Sewell Read: the *Reserved Number*, to his about 2 years and 5 months-old, black, in-calf; bred by George Hood, Windmill Hill, Pembroke.

Clare Sewell Read: First Prize, 10*l.*, for his 1 year and 7 months-old, black; bred by George Hood.

Kerry Bulls.

John Borthwick, J.P., Prospect, Carrickfergus, Antrim: First Prize, 15*l.*, for his 5 years and 2 months-old "King of Kerry," black; bred by himself; sire, "Black Knight;" dam, "Norah."

James Smith, Moyle, Carlow: First Prize, 10*l.*, for his 2 years 10 months and 19 days-old, "The Mountain Chief," black; bred by James Taylor, M.D., Kilmullen, Newtown, Mount Kennedy, Wicklow; sire, "The Black Knight;" dam, "Norah."

Ralph Smith Cusack, Bohomer, St. Doulaghs, Dublin: Second Prize, 5*l.*, for his 1 year and 2 months-old "The King of Kerry," black; bred by himself; sire, "Tommy Moore;" dam, "Lady of the Lake."

Kerry Cows and Heifers.

Ralph Smith Cusack: First Prize, 10*l.*, for his 7 years and 1 month-old "Kathleen," black; bred by John Fitzgerald, Cahirciveen, county Kerry; sire, "Knight of Kerry;" dam, "Norah."

John Borthwick, J.P.: Second Prize, 5*l.*, for his 6 years 3 months and 2 weeks-old "Lady of the Lakes," black; bred by the Earl of Charlemont, Marino, Dublin; sire, "The Knight of Kerry;" dam, "Lady Kenmare."

Ralph Smith Cusack: First Prize, 10*l.*, for his 2 years 3 months and 1 day-old "Sappho," black, in-calf; bred by Richard Mahony, Dromore, Kenmare, Kerry; sire, "King Pippin."

James Smith: Second Prize, 5*l.*, for his 2 years 5 months and 22 days-old "The Mountain Maid," brown, in-milk; bred by the late Sir Edward M'Donnell, New Hagard Lusk, Dublin; sire, "Mangerton;" dam, "Beauty."

John Borthwick, J.P.: First Prize, 10*l.*, for his 1 year and 1 month-old "Kate Kearney," black; bred by the Earl of Charlemont; sire, "Mountain Chief;" dam, "Diana."

Jersey or Alderney Bulls.

David Smith, Browning Hill House, Basingstoke, Hants: the Prize, 10*l.*, for his 3 years and 4 months-old "Paul Potter," brown-chocolate and white; bred by the late Mr. Sivewright, Pepper Park, Reading, Berks.

Albert Le Gallais, La Moie House, Jersey: the *Reserved Number*, to his about 3 years and 2 weeks-old "Butterfly," grey, bred by himself; dam, "Beauty."

Bartholomew Watts, Don Street, St. Heliers, Jersey: the Prize, 5*l.*, for his 2 years and 2 months-old "Noble," brown, fawn, and white; bred by William Alexander, St. Ouens, Jersey.

James Dumbrell, Ditchling, Hurstpierpoint, Sussex: the *Reserved Number*, to his 1 year and 11-months old "Prince Peacock," grey.

Jersey or Alderney Cows and Heifers.

Fowler Newsam, J.P., Stamford Hill, Middlesex: First Prize, 10*l.*, for his about 4 years old, yellow.

John Allnutt, Clapham, Surrey: Second Prize, 6*l.*, for his 5 years and 3 months-old "Princess," brown and white; bred by himself; sire, "Prince;" dam, "Princess."

Albert Le Gallais, La Moie House, St. Aubins, Jersey: Third Prize, 4*l.*, for his 6 years 11 months and 3 weeks-old twin cow, grey and white; bred by C. Robin, Steephill, St. Heliers, Jersey; sire, Le Motlee's bull.

Albert Le Gallais: the *Reserved Number*, to his 6 years 11 months and 3 weeks-old twin cow, grey and white; bred by C. Robin; sire, Le Motlee's bull.

Albert Le Gallais: First Prize, 10*l.*, for his 2 years and 4 months-old, grey and white, in-calf.

Charles Philip Le Cornu, Beaumont, Jersey: Second Prize, 5*l.*, for his 2 years 4 months and 27 days-old, grey, in-calf; bred by himself.

The Rev. William Lemprière, Rozel Manor, St. Heliers, Jersey: the *Reserved Number*, to his 2 years 4 months and 1 week-old "Rozella," brown and white, in-calf; bred by himself; sire, "Dapper;" dam, "Cæsarea."

Guernsey Bulls.

John Rougier, Golden Spurs, St. Peter's Port, Guernsey: the Prize, 10*l.*, for his 3 years and 2 months-old "Johnny," pale red; bred by John Carey, St. Helene, St. Peter's Port.

Eldred Beck, Quevillette, St. Martin's, Guernsey: the Prize, 5*l.*, for his 2 years and 4 months-old "Albert," fawn and white; bred by himself; sire, a prize bull of Mrs. Corey's; dam, "Fancy."

Guernsey Cows and Heifers.

John Allnutt: First Prize, 10*l.*, for his 4 years 4 months and 4 days-old "Kerry," tortoiseshell; bred by himself; sire, "Prince;" dam, "Kerry."

Henry De Jersey Le Lachen, Norgiots, St. Andrews, Guernsey: Second Prize, 6*l.*, for his 4 years 8 months and 25 days-old "Whitish," light red and white; bred by Henry Martel, Corveoux, Vale, Guernsey.

Eldred Beck, Quivillitte, St. Martins, Guernsey: Third Prize, 4*l.*, for his 6 years-old "Alice," fawn and white, in-calf; bred by the late Sir William Collins, St. Peter's Port.

John Rougier: First Prize, 10*l.*, for his 2 years 10 months and 20 days-old "Guernsey Lily," pale red and white, in-calf; bred by Nicholas Domaille, Marais, St. Peter's Port.

John Allnutt: Second Prize, 5*l.*, for his 1 year 5 months and 11 days-old "Blossom," fawn, in-calf; bred by himself; sire, "Prince;" dam, "Violet."

PRIZES GIVEN BY THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

Polled Aberdeen and Angus Bulls.

Thomas Lyell, Shielhill, Kirriemuir, Forfarshire: First Prize, 20*l.*, for his 3 years 3 months and 16 days-old "Prospero," black (Polled Angus); bred by himself; sire, "Mariner;" dam, "Mary."

The Earl of Southesk, Kinnaird Castle, Brechin, Forfar: Second Prize, 10*l.*, for his 3 years 1 month and 9 days-old "Druid" (225), black (Polled Angus); bred by himself; sire, "Cupbearer;" dam, "Dora."

Thomas Lyell: Third Prize, Silver Medal, for his 4 years 3 months and 11 days-old "Tom Pipes" black (Polled Angus); bred by himself: sire, "Mariner;" dam, "Lady Ann."

Robert Walker, Hillside House, Portlethen, Aberdeen: the *Reserved Number*, to his 5 years 2 months and 15 days-old "Duke of Wellington," black (Polled Aberdeen and Angus); bred by himself; sire, "Marquis;" dam, "Lively."

James Alexander Pierson, The Guynd, Arbroath, Forfarshire: First Prize, 20*l.*, for his 2 years 2 months and 26 days-old "Young Alford," black (Angus), bred by himself; sire, "Alford;" dam, "Elizabeth."

Robert F. O. Farquharson, Houghton, Alford, Aberdeen: Second Prize, 10*l.*, for his 2 years 5 months and 24 days-old "Garibaldi," black (Aberdeenshire); bred by William McCombie, Tillyfour, Whitehouse, Aberdeen; sire, "Rob Roy;" dam, "Pride of Aberdeen."

The Earl of Southesk: Third Prize, Silver Medal, for his 2 years and 2 months-old "Diodorus," black (Angus), bred by himself; sire, "Windsor" (221); dam, "Dora" (332).

Alew Paterson, Mulben, Blackhilloch, Morayshire: the *Reserved Number*, to his 2 years 5 months and 17 days-old "Prince of Wales," black (Angus and Aberdeen); bred by George Brown, Westertown, Fochabars, Moray; sire, "Prince Albert" (237); dam, "Paris Kate" (309).

William McCombie, Tillyfour, Aberdeen: First Prize, 10*l.*, for his 1 year 2 months and 23 days-old "Rifleman," black (Aberdeenshire); bred by himself; sire, "Rob Roy;" dam, "Pride of Aberdeen."

Thomas Lyell: Second Prize, 5*l.*, for his 1 year 4 months and 15 days-old "Commodore Trunnion," black (Angus); bred by himself; sire, "Tom Pipes" (301); dam, "Mary of Shielhill" (563).

The Earl of Southesk: Third Prize, Silver Medal, for his 1 year 3 months and 27 days-old "Julius Cæsar," black (Angus); bred by himself; sire, "Lord Clyde" (249); dam, "Empress."

Polled Aberdeen and Angus Cows and Heifers.

William McCombie: First Prize, 10*l.*, for his 5 years old "Pride of Aberdeen," black (Aberdeenshire), in-calf; bred by himself; sire, "Hanton;" dam, "Charlotte."

William McCombie: Second Prize, 5*l.*, for his 11 years old "Charlotte," black (Aberdeenshire), in-milk; bred by himself; sire, "Angus;" dam, "Lola Montez."

The Earl of Southesk: Third Prize, Silver Medal, for his 6 years 3 months and 23 days-old "Queen" (445), black (Angus), in-calf; bred by the Trustees of the late Robert Scott, Balwyllo; sire, "Rob Roy" (56); dam, "Maggie" (433).

William McCombie: First Prize, 10*l.*, for his 2 years 4 months and 11 days-old, "Lovely," black (Aberdeenshire); bred by himself; sire, "Rob Roy;" dam, "The Belle."

William McCombie: Second Prize, 5*l.*, for his 2 years 2 months and 25 days-old "Zara," black (Aberdeenshire); bred by John Collie, Ardgay, Forres, Elgin; sire, "Kinnaird;" dam, "Hinda."

The Earl of Southesk: Third Prize, Silver Medal, for his 2 years 5 months and 12 days-old "Columbia," black (Angus); bred by himself; sire, "Windsor" (221); dam, "Caroline."

Robert Walker, Hillside House, Portlethen, Aberdeen: the *Reserved Number*, to his 2 years and 2 weeks-old "Perdita," black (Aberdeen and Angus); bred by the Earl of Southesk; sire, "Druid" (225); dam, "Princess."

The Earl of Southesk: First Prize, 8*l.*, for his 1 year 5 months and 1 week-old "Rosetta," black (Angus); bred by himself; sire, "Druid" (225); dam, "Rosebud" (460).

Alew Paterson: Second Prize, 4*l.*, for his 1 year 4 months and 12 days-old black (Angus and Aberdeen); bred by himself; sire, "Duke;" dam, "Beauty."

Allan Pollok, Lismany, Ballinasloe, Galway: Third Prize, Silver Medal, for his 1 year 2 months and 18 days-old "Kylemore," black; bred by himself; dam, "Molly;" sire of dam, "Tillyfour."

Polled Galloway Bulls.

James Beattie, Newbie House, Annan, Dumfries: First Prize, 20*l.*, for his 7 years and 2 months-old "Mosstrooper 3rd," black (Galloway); bred by himself; sire, "Mosstrooper;" dam, "Lady."

Joseph Marsland, Glenae, Dumfries: Second Prize, 10*l.*, for his 4 years 6 months and 4 days-old "Samson," black (Galloway); bred by Samuel Cunningham, Dimrod Mill, Kirkcudbright.

James Graham, Meikle Culloch, Dalbeattie, Kirkcudbright: Third Prize, Silver Medal, for his 5 years 1 month and 13 days-old "Hannibal" (201); bred by himself; sire, "Guardsman;" dam, "Hannah" (214).

Patrick Dudgeon, Cargin, Dumfries: the *Reserved Number*, to his 3 years 3 months and 16 days-old "Cargin," black (Galloway); bred by Mr. Halliday, Kirkcudbright.

Alexander Jardine, Applegirth, Lockerbie, Dumfries: First Prize, 10*l.*, for his 1 year 5 months and 1 week-old "Hector," black (Galloway); bred by James Cunningham, Tarbrock, Castle Douglas, Stewartry of Kirkcudbright; sire, "Stanley;" dam, "Nancy."

Patrick Dudgeon: Second Prize, 10*l.*, for his 1 year 3 months and 27 days-old "Frank," black (Galloway); bred by himself; sire, "Cargin;" dam, "Susie."

Polled Galloway Cows and Heifers.

James Beattie: First Prize, 10*l.*, for his 5 years and 3 months-old "Bridesmaid," black (Galloway), in-milk, with calf at foot; bred by himself; sire, "Mosstrooper 3rd;" dam, "Bride."

The Duke of Buccleuch and Queensberry, Drumlanrig, Thornhill, Dumfries: Second Prize, 5*l.*, for his 6 years 5 months and 18 days-old "McGill" (240), black (Galloway), in-milk and in-calf; bred by himself; sire, "Marshall; dam, "Halliday."

The Duke of Buccleuch and Queensberry: Third Prize, Silver Medal, for his 5 years 3 months and 3 weeks-old "Barndannoch," black (Galloway), in-milk and in-calf; bred by William Irving, Barndannoch, Auldgirth Bridge, Dumfries; sire, "Young Mosstroper;" dam, "Soucie."

James Graham: First Prize, 10*l.*, for his 2 years 4 months and 4 days-old "Emma 2nd," black (Galloway); bred by himself; sire, "Sir William;" dam, "Hannah" (214).

The Duke of Buccleuch and Queensberry: Second Prize, for his 2 years 5 months and 2 days-old "Mary," black (Galloway), in-calf; bred by himself; sire, "Freebooter" (203); dam, "Mary."

The Duke of Buccleuch and Queensberry: Third Prize, Silver Medal, for his 2 years 4 months and 1 day-old "Jean," black (Galloway), in-calf; bred by himself; sire, "Freebooter" (203); dam, "Jean."

The Duke of Buccleuch and Queensberry: the *Reserved Number*, to his 2 years 2 months and 20 days-old "Agnes" (Galloway), in-calf; bred by himself; sire, "Freebooter" (203); dam, "McGill" (240).

The Duke of Buccleuch and Queensberry: First Prize, 8*l.*, for his 1 year 3 months and 20 days-old "Miss McGill," black (Galloway); bred by himself; sire, "Freebooter" (203); dam, "McGill" (240).

Samuel Thomson, Blaiker, Crocketford, Kirkcudbright: Second Prize, 4*l.*, for his 1 year 5 months and 9 days-old "Queen Mary," black, with a little white (Galloway); bred by himself; sire, "Sir William;" dam, "Mary."

Patrick Dudgeon: Third Prize, Silver Medal, for his 1 year 3 months and 24 days-old "Betty," black (Galloway); bred by himself; sire, "Cargin;" dam, "Bessie."

Samuel Thomson: the *Reserved Number*, to his 1 year 4 months and 20 days-old "Duchess," black (Galloway); bred by himself; sire, "Sir William;" dam, "Maggie."

Highland Bulls.

John Malcolm, Poltalloch, Callton-Mor, Lochgilphead, Argyll: First Prize, 20*l.*, for his 6 years and 1 month-old "Duntroon," brindled; bred by the Marquis of Breadalbane, Taymouth, Kenmure, Perth.

Allan Pollok, Ronachan, Clachan-Cantire, Argyll: Second Prize, 10*l.*, for his 7 years 2 months and 1 week-old "Jura," black; bred by the late Neil Malcolm, Poltalloch, Lochgilphead, Argyll.

D. Fletcher, Glenards Tovermory, Argyll, and Givon's Grove, Leatherhead, Surrey: Third Prize, Silver Medal, for his 5 years and 1 month-old, yellow or chesnut; bred by himself.

The Marquis of Breadalbane, Taymouth Castle, Aberfeldy, Perth: First Prize, 10*l.*, for his 3 years 2 months and 2 days-old, dun; bred by himself; dam, "Queen."

Robert Anderson, Lochelhi Kildrummie, Nairn: First Prize, 10*l.*, for his 2 years 5 months and 16 days-old, black; bred by John Gordon, Balintomb, Grantown, Inverness.

Highland Cows and Heifers.

John Malcolm: First Prize, 10*l.*, for his 5 years and 2 months-old "Shuna," dun, in-milk and in-calf; bred by himself; sire, "Lailt;" dam, "Bonny."

Allan Pollok: Second Prize, 5*l.*, for his 4 years and 18 days-old "Perth," black, in-calf; bred by himself.

Peter Beattie, Dannydeers, Insch, Aberdeen: Third Prize, Silver Medal, for his 4 years and 5 months-old yellow, in-milk; bred by A. Campbell, Ormsarry, Argyll.

Allan Pollok: the *Reserved Number*, to his 7 years and 2 months-old "Blackie," black, in-milk; bred by Richard D. Campbell, Jura, Laggs-Jura, Argyll.

The Marquis of Breadalbane: First Prize, 10*l.*, for his 3 years 2 months and 18 days-old "Prosaig," dun; bred by himself; dam, "Fessy-dhu."

The Marquis of Breadalbane: Second Prize, 5*l.*, for his 3 years 3 months and 25 days-old "Newrack," cream colour; bred by himself; dam, "Grace."

Allan Pollok: Third Prize, Silver Medal, for his 3 years 2 months and 2 weeks-old "Stonefield," yellow; bred by himself.

Robert Anderson: the *Reserved Number*, to his 3 years 1 month and 1 day-old black; bred by John Stewart Duntallan, Portree, Isle of Skye.

The Marquis of Breadalbane: First Prize, 8*l.*, for his 2 years 3 months and 3 days-old dun; bred by himself; dam, "Queen."

The Marquis of Breadalbane: Second Prize, 4*l.*, for his 2 years 4 months and 17 days-old dun; bred by himself; dam, "Dounag."

John Malcolm: Third Prize, Silver Medal, for his 2 years 3 months and 15 days-old "Reeven," black; bred by himself; sire, "Ford;" dam, "Reeven."

John Malcolm: the *Reserved Number*, to his 2 years 3 months and 2 weeks-old "Scainvhor," black; bred by himself; sire, "Ford;" dam, "Scainvohr."

Ayrshire Bulls.

The Duke of Hamilton and Brandon, Hamilton Palace, Lanark: First Prize, 20*l.*, for his 5 years and 1 week-old "Sir Colin," white and brown flecked; bred by James Frew, Ballinalloch, Kilsyth, Stirling; sire, "Sir Walter;" dam, "Queen of Beauty."

Walter Weir, Barmulloch, Springburn, Lanark: Second Prize, 10*l.*, for his 3 years 9 months and 26 days-old "Lord Douglas," brown and speckled; bred by Adam Strong and Co., Hoggam Field, Glasgow.

John Stewart, Burnside Cottage, Strathaven, Lanark: First Prize, 20*l.*, for his 2 years and 3 months old "Carnal," dark brown and white; bred by William Craig, Cunningham Badland, Dalry, Ayr.

The Duke of Atholl, Dunkeld, Perth: Second Prize, 10*l.*, for his 2 years and 2 months-old, white and brown; bred by James Forrester, Kepderroch, Gargnnoch, Stirlingshire; sire, "Sir Colin;" dam, "Lady-dasher."

John Stewart: First Prize, 10*l.*, for his 1 year and 4 months-old, "Defiance," white flecked; bred by William Eskin, Back of Hill, Houston, Renfrew.

Alexander Oswald, Auchincruive, Ayr: Second Prize, 5*l.*, for his 1 year 2 months and 3 weeks-old "Saint Quivox," dark brown and white; bred by himself; sire, "Charlie;" dam, "Marion."

John Stewart: Third Prize, Silver Medal, for his 1 year and 2 months-old, flecked, with brown and white; bred by John Robertson, Hacket, Dunlop, Ayr.

Ayrshire Cows and Heifers.

The Duke of Atholl: First Prize, 10*l.*, for his 7 years-old, "Colly Hill," white and red spots; bred by — Craig, Colly Hill, Strathaven, Lanark.

The Duke of Hamilton and Brandon: Second Prize, 5*l.*, for his 4 years and 27 days-old, "Merryton," white and red; bred by James Howie, Burnhouses, Galston, Ayr.

Mrs. Wilson, Forehouse, Kilbarcham, Renfrewshire: Third Prize, Silver Medal, for her 5 years and 2 months-old, brown and white.

The Duke of Atholl: the *Reserved Number*, to his 5 years and 1 month-old "Castleburn," brown and white; bred by James Brown, Castleburn, Kilwinning, Ayrshire; dam, "Fleching."

The Duke of Hamilton and Brandon: First Prize, 10*l.*, for his 6 years 2 months and 3 weeks-old "Kilburnie," dark red; bred by William Caldwell, Boytleston, Ardrossan, Ayr.

The Earl of Strathmore, Glamis House, Glamis, Forfar: Second Prize, 5*l.*, for his 3 years 1 month and 2 weeks-old, brown and white; bred by Lawrence Drew, Merryton, Lanark; sire, "Sandy;" dam, "Agnes."

The Earl of Strathmore: Third Prize, Silver Medal, for his 4 years and 2 months-old, brown and white; bred by Mr. Logan, East Kilbride, Lanark.

Mrs. Wilson: the *Reserved Number*, to her 4 years and 2 months-old, brown and white; bred by herself.

John Stewart: First Prize, 10*l.*, for his 2 years 3 months and 2 weeks-old "Corslet," brown with spots; bred by David Cameron, Corslet, Newton Mearns, Renfrew.

Alexander Oswald: Second Prize, 5*l.*, for his 2 years and 2 months-old "Edith," light brown and white; bred by Mr. Torrens, Mount Pleasant, Kilmains, Ayr; sire, "Caledonia."

Alexander Oswald: Third Prize, Silver Medal, for his 2 years and 2 months-old "Elizabeth," white and light brown; bred by Mr. Torrens; sire, "Caledonia."

David Tweedie, Castle Crawford, Abington, Lanark: the *Reserved Number*, to his 2 years 1 month and 3 days-old "Ewing," brown and white; bred by himself; sire, "The Prince;" dam, "Ewing."

John Stewart: First Prize, 8*l.*, for his 1 year and 3 months-old "Koxey," white and brown; bred by John Marshall, Arblees, Motherwell, Lanark.

John Stewart: Second Prize, 4*l.*, for his 1 year and 2 months-old "Basay," brown and white flecked: bred by William Stirrat, Lochrig, Kilburnie, Ayr.

John Stewart: Third Prize, Silver Medal, for his 1 year and 3 months-old "Rosy," brown; bred by James Orr, Lochrig, Kilbirnie, Ayr.

The Duke of Hamilton and Brandon: the *Reserved Number*, to his 1 year 1 month and 11 days-old "Jessie," white and red; bred by Lawrence Drew, Merryton, Hamilton, Lanark; dam, "Airdochrigg."

HORSES.

Thorough-bred Stallions.

Henry Richard Phillips, Albert Gate, Knightsbridge, and Willesden Paddocks, Kilburn, Middlesex: First Prize, 100*l.*, for his 9 years-old "Ellington," dark brown; bred by Admiral Harcourt, Sareton Park, Bedale, Yorkshire; sire, "The Flying Dutchman;" dam, "Ellerdale."

Charles Edwards Johnstone, 105, Gloucester Place, Portman Square: Second Prize, 25*l.*, for his 6 years-old "The Marionette," brown; bred by Mr. Johnstone, Sheffield-lane Paddocks, Sheffield, Yorkshire; sire, "Touchstone;" dam, "Marion."

Tom Hussey, Stud Farm, Skirmett, Henley-on-Thames, Oxfordshire: the *Reserved Number*, to his 13 years-old, "Sir John Barleycorn," dark brown; bred by himself; sire, "The Baron;" dam, "Loveslip."

Hunter Stallions.

JOHN MANNING, Orlingbury, Wellingborough, Northamptonshire: First Prize, 30*l.*, for his 5 years-old "British Statesman," very dark bay; bred by Sir Wilfred Lawson, Bart., Brayton Hall, Carlisle; sire, "British Yeoman;" dam, "Madam."

ROUS JOHN COOPER, Blythburgh Lodge, near Halesworth, Suffolk: Second Prize, 15*l.*, for his 3 years-old "Billy Barlow," bay; bred by Mr. Ferguson, Harcour Lodge, Carlisle, Cumberland; sire, "Royal Ravenhill."

ROBERT GLASSCOCK, Great Saling, Braintree, Essex: the *Reserved Number*, to his 16 years-old "Horatio," dark brown; bred by Thomas Dixon Ridley, Chelmsford; sire, "Cain."

Hunter Brood Mares.

LORD BERNERS, Keythorp Hall, Leicester: First Prize, 20*l.*, for his 14 years-old "Barbara," bay; bred by himself; sire, "Sportsman."

Hunter Geldings.

ROBERT AND JOHN RUSSELL, Horton Kirby, Dartford, Kent: First Prize, 20*l.*, for their 5 years and 2 months-old, chesnut; bred by John Russell, Horton Kirby; sire, "Marsyas."

JOHN HENRY ELWES, Colesbourne, Cheltenham: Second Prize, 10*l.*, for his 5 years-old, bay; sire, "Prince Royal."

JOHN B. BOOTH, Killerby, Catterick, Yorkshire: the *Reserved Number*, to his 4 years-old, "Beechwood," bay and brown; bred by S. Atkinson, Darlington; sire, "Lancewood."

Hunter Mare.

JOHN ROBINSON, Hutton, Rudly-by-Yarm, Yorkshire: First Prize, 20*l.*, for his 4 years-old "Lady Bird," bay; bred by himself; dam, "Cleveland Lass."

Carriage Stallions.

GEORGE HOLMES, Newbegin, Beverley, Yorkshire: First Prize, 20*l.*, for his 4 years-old "Young Pottinger," brown; bred by Mr. Dodsworth, Seamer, Yarm; sire, "Pottinger."

JOSEPH KITCHIN, Dunsdale, Westerham, Kent: Second Prize, 10*l.*, for his 7 years-old "Speculation," bay; bred by Marmaduke Walker, Addington Lodge, Croydon, Surrey; sire, "Cleveland Short Legs;" dam, "Coldstream."

Carriage Brood Mare.

ROUS JOHN COOPER: First Prize, 20*l.*, for his 7 years-old bay; bred by Mr. Turdell, Sutton, Yorkshire; sire, "Brutandorf."

GEORGE HOLMES: Second Prize, 10*l.*, for his 10 years-old, "Polly," bay; bred by Mrs. Maughan, Normanby, Middlesborough; sire, "Illustrious Stranger."

HENRY PLATT, Bryn-y-Newadd, Bangor, Carnarvonshire: the *Reserved Number*, to his 7 years-old, "Wonderful Lass," bay; bred by John Smith, Longnewton, Darlington; sire, "Wonderful Lad."

Roadster Stallions.

WILLIAM JOHNSON, Billinghay, Sleaford, Lincolnshire: First Prize, 20*l.*, for his 10 years-old "Merry-legs," bay; bred by himself; sire, "Old Merry-legs;" dam, 'Negotiation."

HUNTINGTON MARTIN, The Lawns, Downham, near Ely, Cambridgeshire: Second Prize, 10*l.*, for his 6 years-old "Crocus," brown; bred by himself; sire, "Young Fire-away."

DENNIS TOPHAM MOSS, 16, Camden Terrace, Leeds, Yorkshire: the *Reserved Number*, to his 5 years-old "Buck Merry-legs," bay; bred by himself; sire, "Flying Buck;" dam, "Miss Burlington."

Roadster Brood Mares.

JONATHAN PEEL, Knowlmere Manor, Clitheroe, Yorkshire: First Prize, 20*l.*, for his 19 years-old "Jessie," brown; sire, "Sportsman."

HUGH JOSCELINE PERCY, Eskrigg, Wigton, Cumberland: Second Prize, 10*l.*, for his 4 years-old "Crafty," brown; bred by Mrs. Dalzell, Stainburn Hall, Workington, Cumberland; sire, "The Judge;" dam, "Crafty."

Agricultural Stallions (Suffolks).

HERMAN BIDDELL, Playford, Ipswich, Suffolk: First Prize, 30*l.*, for his 5 years and 3 months-old "Colonel," chesnut; bred by Thomas Read, Rendlesham, Wickham Market, Suffolk; sire, "Major."

THOMAS CRISP, Butley Abbey, Wickham Market: Second Prize, 15*l.*, for his 12 years-old "Marquis," chesnut; bred by Charles Cordy, Trimley, Ipswich; sire, "Royal Duke" (the late Mr. Catlin's).

THOMAS CRISP: the *Reserved Number*, to his 6 years old "Champion," chesnut; bred by C. Barne, Kettleburgh, Wickham Market; sire, "Boxer."

HENRY GILES, jun., Bull Hill, Great Clacton, Colchester, Essex: First Prize, 20*l.*, for his 2 years 3 months and 10 days-old "Boxer," chesnut; bred by himself; sire, "Hick's Prince;" dam, "Brock."

THOMAS CRISP: Second Prize, 10*l.*, for his 2 years-old, chesnut; bred by himself; sire, "Marquis."

WILLIAM STEARN, Elmset Hall, Hadleigh, Suffolk: the *Reserved Number*, to his 2 years 1 month and 3 weeks-old "Young Boxer," red chesnut; bred by G. F. Parson, Waldringfield, Sudbury, Suffolk; sire, "Old Boxer."

Agricultural Mares and Fillies (Suffolks).

WILLIAM THOMPSON, jun., Rose Cottage, Thorpe, Colchester: First Prize, 20*l.*, for his 9 years-old "Darby," chesnut.

SAMUEL WOLTON, Newbourn Hall, Woodbridge, Suffolk: Second Prize, 10*l.*, for his 7 years-old "Moggy," chesnut; bred by himself; sire, Catlin's "Royal Duke;" dam, "Moggy."

EDWARD GOWING HODGSON, Charsfield Hall, Wickham Market: the *Reserved Number*, to his 6 years-old "Smart," chesnut; bred by himself; sire, Barthropp's "Canterbury Pilgrim."

GEORGE TOMLINE, M.P., Nacton, Ipswich, Suffolk: First Prize, 15*l.*, for his 2 years and 2 months-old, chesnut; bred by himself; sire, "Hero;" dam, "Darby."

Nathaniel George Barthropp, Cretingham Rookery, Wickham Market: Second Prize, 10*l*., for his 2 years-old, chesnut; bred by William Keer, Levington, Ipswich; sire, Barthropp's "Hero."

Samuel Wolton: the *Reserved Number*, to his 2 years-old, chesnut; bred by himself; sire, Barthopp's "Hero;" dam, "Smart."

Agricultural Stallions (not Suffolks).

George Kempson, Pegsdon Bottom Farm, Hitchin, Herts: First Prize, 30*l*., for his 3 years-old "Young Champion," bay; bred by himself; sire, "Lion King;" dam, "Diamond."

Matthew Reed, Beamish Burn, Chester-le-street, Durham: Second Prize, 15*l*., for his 6 years and 1 month-old "England's Glory," bay; bred by William Pank, Borough Fen, Northamptonshire; sire, "England's Glory;" dam, "Sweep."

John Brown, Compton, Newbury, Berks: the *Reserved Number*, to his 4 years and 1 month-old "Benjamin Bobbin," dark grey; bred by William Aldworth, Frilford, Abingdon, Berks; sire, "The Bloomer."

David Begbie, Morden, Mitcham, Surrey: First Prize, 20*l*., for his 2 years 1 month and 3 days-old "Young Briton," grey; bred by himself; sire, "Young England's Glory."

The Hon. Colonel Pennant, M.P., Penrhyn Castle, Bangor, Carnarvonshire: Second Prize, 10*l*., for his 2 years 3 months and 5 days-old, bay; bred by himself; sire, "Nonpareil;" dam, "Coll."

James Oram, Shellingford, Farringdon, Berkshire: the *Reserved Number*, to his 2 years and 26 days-old "Young Champion," chesnut; bred by himself; dam, "Diamond."

Agricultural Mares and Fillies (not Suffolks).

John Gay Attwater, Hallingwood Farm, Cubberley, Cheltenham, Gloucestershire: First Prize, 20*l*., for his 6 years-old "Bonnie," roan; bred by himself; sire, "Young Noble;" dam, "Diamond."

Edward Redding, Compton Marsh, Farringdon, Berks: Second Prize, 10*l*., for his 11 years 2 months and 2 weeks-old "Diamond," dark brown; bred by himself; sire, "The Farmer's Glory;" dam, "Jewell."

The late Sir Robert George Throckmorton, Bart., Buckland, Farringdon: the *Reserved Number*, to his 9 years-old "Smiler," brown.

Edward Phillimore, 119, High Street, Cheltenham, Gloucestershire: First Prize, 15*l*., for his 2 years 2 months and 12 days-old "Bonny," iron grey; bred by John Waddingham, Guiting Grange, Winchcombe, Gloucestershire; sire, "Sir William;" dam, "Bonny."

The Duke of Richmond, Goodwood, Chichester, Sussex: Second Prize, 10*l*., for his 2 years-old "Sally," bay; bred by himself; sire, "Old Briton;" dam, "Clyde."

The Duke of Richmond: the *Reserved Number*, to his 2 years-old "Clyde," brown; bred by himself; sire, "Young Briton;" dam, "Jane."

Dray Stallions.

John Foster, Bingham, Nottingham: Prize 30*l*., for his 4 years-old "Enterprise," black roan; bred by himself; sire, "Young Champion;" dam, "Beauty."

William Henry Neale, Old Eclipse Inn, Mansfield, Nottinghamshire: Prize 20*l.*, for his 2 years-old "London Prince," dark grey; bred by himself; sire, "Waterloo;" dam, "Bonny."

Dray Mares and Fillies.

William Fullard, Thorney, near Peterborough, Cambs: Prize 20*l.*, for his 7 years-old "Bonny," bay; bred by himself; sire, "Golden Ball;" dam, "Bright."

John K. Tombs, Langford, Lechlade, Gloucestershire: Prize 15*l.*, for his 2 years-old, dark bay.

Pony Stallions above 12½ *and under* 14 *hands.*

William Blenkiron, Middle Park, Eltham, Kent: First Prize, 15*l.*, for his 10 or 11 years-old "Napoleon," dun (Welsh).

Michael Sherring Ashwell, Barrowby, Grantham, Lincolnshire: Second Prize, 5*l.*, for his 4 years 10 months and 15 days-old, chesnut; bred by himself; sire, "Record;" dam, "Lady Jane."

John Beevor, M.D., Mill Gate, Newark, Notts: the *Reserved Number*, to his 22 years-old "Bobby," bay; bred by the late W. K. Ramsay; sire, "Round Robin."

Pony Mares above 12½ *and under* 14 *hands.*

Francis Cook Matthews, Driffield, Yorkshire: First Prize, 10*l.*, for his 6 years-old "Ozone," brown (roadster); sire, "Croton Oil."

Frederick Branwhite, Long Melford, Sudbury, Suffolk: Second Prize, 5*l.*, for his 6 years-old "Pretty Girl," roan (Norfolk); bred by himself; sire, "Phenomenon;" dam, "Brown Bess."

John Beevor, M.D.: the *Reserved Number*, to his 4 years-old "Brazilia," chesnut; bred by himself; sire, "Bobby;" dam, "Manilla."

Pony Geldings above 12½ *and under* 14 *hands.*

Frederick Branwhite: the Prize 10*l.*, for his 5 years-old "Pretty Boy," roan (Norfolk); bred by Mr. Wibrew, Shimpling, Sudbury; sire, "St. Hubert."

Pony Stallions not exceeding 12½ *hands.*

Thomas Baker, Lynton, Barnstaple, Devon: the Prize 15*l.*, for his 5 years-old "Gem," bay (Exmoor); bred by Robert Smith, Emmett's Grange, South Molton, Devon; sire, "Grey Friar;" dam, "Tickle-me-gently."

Pony Mares not exceeding 12½ *hands.*

William Henry Walker, Wennington, Romford, Essex: First Prize, 10*l.*, for his 5 years-old "Kitty," mixed colour (Home-bred).

John Jefferies Stone, Ashton Villa, Wickham-road, Upper Lewisham-road, Kent: Second Prize, 5*l.*, for his 3 years 1 month 15 days-old "Cambria," brown (Welsh); bred by Frederick Nevins Flintoff, Scyborwen House, Llantrissant, Usk, Monmouthshire.

Pony Geldings not exceeding 12½ *hands.*

Lord Braybrooke, Heyden, Royston, Essex: the Prize 10*l.*, for his 5 years-old "Comet," grey (Exmoor).

PRIZES GIVEN BY THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

Clydesdale Stallions and Colts.

THE DUKE OF HAMILTON AND BRANDON, Hamilton Palace, Lanark: First Prize, 30*l.*, for his 7 years and 11 days-old "Sir Walter Scott," bay; bred by George Scott, Ban, Largs, Ayr; sire, "Clyde;" dam, "Maggie."

WILLIAM KERR, Lochend, Kilburnie, Ayrshire: Second Prize, 15*l.*, for his 6 years and 15 days-old "Champion," bay; bred by Mr. Fleming, Auchenbothy, Kilmalcolm, Renfrew; sire, "Prince;" dam, "Jest."

WILLIAM STIRLING, M.P., Kerr, Dunblane, Perth: Third Prize, SILVER MEDAL, for his 5 years 1 month and 2 weeks-old "Forth," bay; bred by himself; sire, "Clyde;" dam, "Darling."

JAMES M'ARTNEY, Muchhart, Perth: the *Reserved Number*, to his 4 years and 1 month-old "Garibaldi," bay; bred by himself; sire, "Clyde;" dam, "Nance."

ROBERT MOWBRAY, Cambus, Clackmannan: First Prize, 20*l.*, for his 2 years 2 months and 17 days-old, bay; bred by himself; sire, "Prince of Wales;" dam, "Tipsey."

DANIEL LOGAN, Netherton, Renfrew: Second Prize, 10*l.*, for his 3 years-old "Rantan Robin," brown; bred by Samuel Boyd, Ardnacross, Campbelton, Argyll; sire, "Lofty;" dam, "Nancy."

JOHN HENDRIES, Kirkwood, Coatbridge, Lanark: Third Prize, SILVER MEDAL, for his 2 years and 1 month-old "Colonel," dark bay; bred by D. C. R. C. Buchanan, Drumpella, Coatbridge; sire, "Ben Lomond;" dam, "Jessie."

ROBERT MOWBRAY: the *Reserved Number*, to his 2 years 5 months and 2 days-old; bred by himself; sire, "Prince of Wales;" dam, "Jess."

Clydesdale Mares and Fillies.

JOHN KERR, Morton, Mid Calder, Edinburgh: First Prize, 20*l.*, for his 6 years-old "Rosie," brown.

JAMES GRAY, Blawart Hill, Yoker, Renfrew: Second Prize, 10*l.*, for his 5 years and 1 month-old "Jessie," bay; bred by himself; sire, "Rob Roy;" dam, "Jessie."

COLONEL BUCHANAN, Drumpellier House, Coatbridge, Lanark: Third Prize, SILVER MEDAL, for his 12 years-old "Jess," black.

WILLIAM STIRLING, M.P.: First Prize, 16*l.*, for his 6 years 1 month and 16 days-old "Nancy," bay; bred by Moses Steven, Bellahouston, Govan by Glasgow; sire, "Lord Raglan;" dam, "Maggie."

THE DUKE OF HAMILTON AND BRANDON: Second Prize, 8*l.*, for his 3 years 11 months and 19 days-old "Princess Maud," bay; bred by William Park, Balcohanaran, Dalmines, Dumbarton; sire, "Sir Colin;" dam, "Jess."

WILLIAM STIRLING, M.P.: Third Prize, SILVER MEDAL, for his 7 years and 2 months-old "Jess," light bay; bred by Andrew Buchanan, Milton, Kilmalcolm, Renfrew; sire, "Prince."

WILLIAM STIRLING, M.P.: the *Reserved Number*, to his 3 years 11 months and 4 days-old "Bessy," bay; bred by Hugh Roger, Attiquin, Maybole, Ayr; sire, "Farmer's Glory;" dam, "Maggie."

Robert Findlay, Easterhill, Glasgow: First Prize, 10*l.*, for his 3 years 1 month and 2 weeks-old "Bessie Bell," bay; bred by Mr. Park.

Robert Findlay: Second Prize, 5*l.*, for his 3 years and 1 month-old "May Gray," bay; bred by himself.

John Hendries: Third Prize, Silver Medal, for his 3 years-old "Jane," bay; bred by Andrew Dunlop, Tirferguss, Campbelton.

Allan Pollok, Ronachan, Kyntire: the *Reserved Number*, to his 3 years 2 months and 2 weeks-old "Jean," light bay; bred by himself; sire, "Broom;" dam, "Jessie."

SHEEP.

Leicester Rams.

William Sanday, Holme Pierrepoint, Notts: First Prize, 20*l.*, for his 16 months-old; bred by himself; sire, "M. Y."

Thomas Edward Pawlett, Beeston, Sandy, Beds: Second Prize, 10*l.*, for his 15 months-old; bred by himself.

William Sanday: Third Prize, 5*l.*, for his 16 months-old; bred by himself; sire, "L. X."

Thomas Edward Pawlett: the *Reserved Number*, to his 15 months-old; bred by himself.

William Sanday: the Gold Medal, and First Prize, 20*l.*, for his 2 years and 4 months-old; bred by himself; sire, "G. N."

William Sanday: Second Prize, 10*l.*, for his 3 years and 4 months-old; bred by himself; sire, "G. N."

William Sanday: Third Prize, 5*l.*, for his 3 years and 4 months-old; bred by himself; sire, "W. X."

William Sanday: the *Reserved Number*, to his 2 years and 4 months-old; bred by himself; sire, "G. N."

Leicester Ewes—Pens of Five.

William Sanday: First Prize, 20*l.*, for his 16 months-old; bred by himself.

William Sanday: Second Prize, 10*l.*, for his 16 months-old; bred by himself.

William Lovel, Nafferton Grange, Driffield, Yorkshire: Third Prize, 5*l.*, for his 15 months-old; bred by himself.

Lieutenant-Colonel William Inge, Thorpe Constantine, Tamworth, Staffordshire: the *Reserved Number*, to his 16 months-old; bred by himself; sire, "D. W.," the property of William Sanday.

Lincoln Rams.

Thomas Bumpstead Marshall, Branston, Lincolnshire: First Prize, 15*l.*, for his 15 months and 2 weeks-old; bred by himself.

Thomas Bumpstead Marshall: Second Prize, 10*l.*, for his 15 months and 2 weeks-old; bred by himself.

James Mayfield, Billinghay Dales, Coningsby, Lincolnshire: Third Prize, 5*l.*, for his 16 months-old; bred by Charles Battersby, Scotterne, Lincoln.

John Clarke, Old Bank House, Long Sutton, Lincolnshire: the *Reserved Number*, to his 15 months and 2 weeks-old; bred by himself.

Thomas Bumpstead Marshall: First Prize, 15*l.*, for his 3 years and 3 months-old; bred by himself.

John Clarke: Second Prize, 10*l.*, for his 3 years 3 months and 2 weeks-old; bred by himself.

James Mayfield: Third Prize, 5*l.*, for his 2 years and 3 months-old; bred by himself.

John Clarke: the *Reserved Number*, to his 3 years 3 months and 2 weeks-old; bred by Thomas Marshall.

Lincoln Ewes—Pens of Five.

William Greetham, Stainfield, Wragby, Lincolnshire: First Prize, 15*l.*, for his 15 months and 3 weeks-old; bred by himself.

Cotswold Rams.

William Garne, Kilkenny Farm, Bibury, Fairford, Gloucestershire: First Prize, 15*l.*, for his 16 months-old; bred by himself.

Edward Handy, Sierford, Cheltenham, Gloucestershire: Second Prize, 10*l.*, for his 15 months and 2 weeks-old; bred by himself.

William Lane, Broadfield Farm, Northleach, Gloucestershire: Third Prize, 5*l.*, for his 14 months and 2 weeks-old; bred by himself.

William Garne: the *Reserved Number*, to his 16 months-old; bred by himself.

William Lane: First Prize, 15*l.*, for his 3 years 4 months and 3 weeks-old; bred by himself.

William Lane: Second Prize, 10*l.*, for his 2 years 3 months and 2 weeks-old; bred by himself.

Edward Handy: Third Prize, 5*l.*, for his 3 years 3 months and 2 weeks-old; bred by himself.

Robert Garne, Aldsworth, Northleach, Gloucestershire: the *Reserved Number*, to his 2 years and 4 months-old; bred by himself.

Cotswold Ewes—Pens of Five.

William Lane: First Prize, 15*l.*, for his 16 months-old; bred by himself.

John King Tombs, Langford, Lechlade, Gloucestershire: Second Prize, 10*l.*, for his 16 months-old; bred by himself.

William Lane: Third Prize, 5*l.*, for his 15 months and 2 weeks-old; bred by himself.

John King Tombs: the *Reserved Number*, to his 16 months-old; bred by himself.

Kentish or Romney Marsh Rams.

Frederick Murton, Smeeth, Ashford, Kent: First Prize, 15*l.*, for his 15 months-old; bred by himself.

Thomas Blake, Sycamore House, Dymchurch, Folkestone, Kent: Second Prize, 10*l.*, for his 14 months-old; bred by himself.

George Jenner, Parsonage House, Udimore, Rye, Sussex: Third Prize, 5*l.*, for his 15 months-old; bred by Robert Kenward, New Place Farm, Icklesham, Rye.

Thomas Blake: the *Reserved Number*, to his 14 months-old; bred by himself.

THOMAS BLAKE: First Prize, 15*l.*, for his 4 years and 2 months-old; bred by himself.

THOMAS BLAKE: Second Prize, 10*l.*, for his 4 years and 2 months-old; bred by himself.

FREDERICK MURTON: Third Prize, 5*l.*, for his 3 years and 3 months-old; bred by himself.

FREDERICK MURTON: the *Reserved Number*, to his 2 years and 3 months-old; bred by himself.

Kentish or Romney Marsh Ewes—Pens of Five.

FREDERICK MURTON: First Prize, 15*l.*, for his 15 months-old; bred by himself.

FREDERICK MURTON: Second Prize, 10*l.*, for his 15 months-old; bred by himself.

GEORGE JENNER: Third Prize, 5*l.*, for his 15 months-old; bred by James Hilder, Lee Farm, Rye, Sussex.

CHARLES MURTON, Lynstead, Sittingbourne, Kent: the *Reserved Number*, to his 14 months and 2 weeks-old; bred by himself.

Long-woolled Rams (not Leicesters, Lincolns, Cotswolds, or Kentish).

JOHN LYNN, Church Farm, Stroxton, Grantham, Lincolnshire: First Prize, 15*l.*, for his 16 months-old (Lincoln and Leicester); bred by himself.

JOHN LYNN: Second Prize, 10*l.*, for his 16 months-old (Lincoln and Leicester); bred by himself.

JOHN LYNN: Third Prize, 5*l.*, for his 16 months-old (Lincoln and Leicester); bred by himself.

HUGH AYLMER, West Dereham Abbey, Stoke Ferry, Norfolk: the *Reserved Number*, to his 16 months-old (West Dereham); bred by himself.

JOSEPH SIMPSON, Spofforth Park, Wetherby, Yorkshire: First Prize, 15*l.*, for his 3 years and 3 months-old; bred by himself.

JOSEPH SIMPSON: Second Prize, 10*l.*, for his 2 years and 3 months-old; bred by himself.

JOSEPH SIMPSON: Third Prize, 5*l.*, for his 3 years 3 months and 1 week-old; bred by himself.

JOHN LYNN: the *Reserved Number*, to his 2 years and 4 months-old (Lincoln and Leicester); bred by himself.

Long-woolled Ewes—Pens of Five (not Leicesters, Lincolns, Cotswolds, or Kentish).

HUGH AYLMER: First Prize, 15*l.*, for his 16 months-old (West Dereham); bred by himself.

JOSEPH SIMPSON: Second Prize, 10*l.*, for his 15 months-old; bred by himself.

JOHN KING TOMBS: Third Prize, 5*l.*, for his 16 months-old (Cotswold Grey); bred by himself.

South Down Rams.

THE EARL OF RADNOR, Coleshill House, Highworth, Wilts: First Prize, 20*l.*, for his 15 months-old; bred by himself.

WILLIAM RIGDEN, Hove, Brighton, Sussex: Second Prize, 10*l.*, for his 16 months-old; bred by himself.

William Rigden: Third Prize, 5*l.*, for his 16 months-old; bred by himself.

William Rigden: the *Reserved Number*, to his 16 months-old; bred by himself.

William Rigden: the Gold Medal, and First Prize, 20*l.*, for his 3 years and 4 months-old; bred by himself.

Lord Walsingham, Merton Hall, Thetford, Norfolk: Second Prize, 10*l.*, for his 2 years 3 months and 2 weeks-old; bred by himself.

Lord Walsingham: Third Prize, 5*l.*, for his 2 years 3 months and 2 weeks-old; bred by himself.

Lord Walsingham: the *Reserved Number*, to his 2 years 3 months and 2 weeks-old; bred by himself.

South-Down Ewes—Pens of five.

The late Sir Robert George Throckmorton, Bart., Buckland, Farringdon, Berks: First Prize, 20*l.*, for his 16 months-old; bred by himself.

Lord Walsingham: Second Prize, 10*l.*, for his 15 months and 2 weeks-old; bred by himself.

The Earl of Radnor: Third Prize, 5*l.*, for his 15 months-old; bred by himself.

Lord Walsingham: the *Reserved Number*, to his 15 months and 2 weeks-old; bred by himself.

Shropshire Rams.

Thomas Horton, Harnage Grange, Shrewsbury, Salop: First Prize, 15*l.*, for his about 15 months-old "Lord Salop;" bred by himself; sire, "Duke of Kent."

Thomas Mansell, Adcott Hall, Shrewsbury: Second Prize, 10*l.*, for his 15 months-old; bred by himself.

Henry Matthews, Montford, Shrewsbury: Third Prize, 5*l.*, for his 15 months-old; bred by himself.

Thomas Horley, Jun., The Fosse, near Leamington, Warwickshire: the *Reserved Number*, to his 15 months-old "Black Prince the 2nd;" bred by himself; sire, "Black Prince."

Thomas Horley, Jun.: First Prize, 15*l.*, for his 3 years 3 months and 15 days-old "Havelock;" bred by himself; sire, "Young Buckskin."

Price William Bowen, Shrawardine Castle, Shrewsbury: Second Prize, 10*l.*, for his 4 years and 3 months-old "Patentee 4th;" bred by S. Byrd, The Lees, Stafford; sire, "Patentee."

Thomas Horton: Third Prize, 5*l.*, for his 3 years 3 months and 2 weeks-old "St. Patrick;" bred by himself; sire, "Old Shropshire."

Lord Wenlock, Bourton Cottage, Much Wenlock, Salop: the *Reserved Number*, to his 2 years and 3 months-old "Tommy No. 1;" bred by himself; sire, "Old Sheep;" dam, "Queen Bet 2nd."

Shropshire Ewes—Pens of five.

James and Edward Crane, Shrawardine, Shrewsbury: First Prize, 15*l.*, for their 1 year 3 months and 2 weeks-old; bred by themselves.

James and Edward Crane: Second Prize, 10*l.*, for their 15 months-old; bred by themselves.

Henry Matthews: Third Prize, 5*l.*, for his 1 year 3 months and 2 weeks-old; bred by himself.

THOMAS HORLEY, Jun.: the *Reserved Number*, to his 15 months-old, bred by himself.

Hampshire and West-Country Down Rams.

STEPHEN KING, Old Hayward Farm, Hungerford, Berks: First Prize, 15*l.*, for his 16 months and 2 weeks-old (West Country Down); bred by himself.

STEPHEN KING: Second Prize, 10*l.*, for his 16 months and 2 weeks-old (West Country Down); bred by himself.

JOHN REEKS NEATE, Northington Farm, Overton, Hants: Third Prize, 5*l.*, for his 17 months and 1 week-old (Improved Hampshire Down); bred by himself.

JAMES L. WALDRON, Marridge Hill, Ramsbury, Wilts: the *Reserved Number*, to his 16 months 2 weeks and 4 days-old (West Country Down); bred by himself.

WILLIAM HUMFREY, Oak Ash, Chaddleworth, Wantage, Berks: First Prize, 15*l.*, for his 2 years and 5 months-old; bred by himself.

WILLIAM HUMFREY: Second Prize, 10*l.*, for his 3 years 5 months and 10 days-old; bred by himself.

STEPHEN KING: Third Prize, 5*l.*, for his 2 years 4 months and 2 weeks-old (West Country Down); bred by himself.

WILLIAM BROWN CANNING, Chisledon, Swindon, Wilts, the *Reserved Number*, to his 2 years 4 months and 2 weeks-old (West Country Down); bred by himself.

Hampshire and West Country Down Ewes—Pens of five.

WILLIAM HUMFREY: First Prize, 15*l.*, for his 16 months and 3 weeks-old (West Country Down); bred by himself.

WILLIAM ROWDEN SHITTLER, Bishopston, Salisbury, Wilts: Second Prize, 10*l.*, for his about 16 months and 2 weeks-old (Improved Hampshire Down); bred by himself.

WILLIAM FRANCIS BENNETT, Chilmark, Salisbury, Wilts: Third Prize, 5*l.*, for his 17 months old (Improved Hampshire); bred by himself.

WILLIAM BROWNE CANNING: the *Reserved Number*, to his 16 months and 2 weeks-old (West Country Down); bred by himself.

CHARLES GILLETT, Cote House, Bampton, Farringdon, Berks: First Prize, 15*l.*, for his 16 months and 3 weeks-old; bred by himself.

CHARLES GILLETT: Second Prize, 10*l.*, for his 16 months and 23 days-old; bred by himself.

CHARLES GILLETT: Third Prize, 5*l.*, for his 17 months-old; bred by himself.

CHARLES GILLETT: the *Reserved Number*, to his 16 months and 26 days-old; bred by himself.

CHARLES GILLETT: First Prize, 15*l.*, for his 2 years 4 months and 27 days-old: bred by himself.

THE EXECUTORS OF THE LATE SAMUEL TREADWELL, Upper Winchendon, Waddesdon, Aylesbury, Bucks: Second Prize, 10*l.*, for his about 3 years 4 months and 2 weeks-old; bred by Charles Gillett, Cote House, Bampton, Oxford.

HENRY BARNETT, Glympton Park, Woodstock, Oxon: Third Prize, 5*l.*, for his 2 years and 4 months-old; bred by H. L. Gaskell, Kiddington Hall, Woodstock, Oxon.

Henry Lomax Gaskell, Kiddington Hall, Woodstock, Oxon: the *Reserved Number*, to his 2 years 4 months and 3 days-old; bred by himself.

Oxfordshire Down Ewes—Pens of five.

Charles Gillett: First Prize, 15*l.*, for his 16 months and 3 weeks-old; bred by himself.

The Duke of Marlborough, Blenheim, Woodstock, Oxon: Second Prize, 10*l.*, for his about 16 months-old; bred by himself.

Charles Howard, Biddenham, Beds: Third Prize, 5*l.*, for his 16 months and 2 weeks-old; bred by himself.

Joseph Druce, Eynsham, Oxford: the *Reserved Number*, to his 16 months and 2 weeks-old; bred by himself.

Dorset Rams.

Thomas Danger, Huntstile, Bridgwater, Somerset: First Prize, 15*l.*, for his 17 months and 3 weeks-old; bred by himself.

Thomas Danger: Second Prize, 10*l.*, for his 17 months and 3 weeks-old; bred by himself.

Frederick Bond, Whitelackinton, Ilminster, Somerset: Third Prize, 5*l.*, for his 18 months-old; bred by William Blake, South Petherton, Somerset.

Frederick Bond: the *Reserved Number*, to his 18 months-old; bred by himself.

Thomas Danger: First Prize, 15*l.*, for his 3 years and 6 months-old; bred by himself.

Thomas Danger: Second Prize, 10*l.*, for his 2 years 5 months and 3 weeks-old; bred by himself.

William Paull, Piddletown, Dorchester: Third Prize, 5*l.*, for his 3 years 5 months and 5 days-old; bred by Matthew Paull, Piddletown.

William Paull: the *Reserved Number*, to his 2 years 5 months and 19 days-old; bred by Matthew Paull.

Dorset Ewes—Pens of five.

Thomas Danger: First Prize, 15*l.*, for his 17 months and 2 weeks-old; bred by himself.

Thomas Danger: Second Prize, 10*l.*, for his 17 months and 2 weeks-old; bred by himself.

Frederick Bond: Third Prize, 5*l.*, for his 18 months-old; bred by himself.

Mountain Rams.

Richard Eastwood, Swinshawe House, Burnley, Lancaster: First Prize, 15*l.*, for his 1 year and 3 months-old "King of the Forest" (Mountain or Lonk); bred by Mrs. Green, Todley Hall, Keighley, Yorkshire.

Richard Eastwood: Second Prize, 10*l.*, for his 15 months-old "King of Bowland" (Mountain or Lonk); bred by Mrs. Green.

James Merson, Brinsworthy, North Molton, Devon: Third Prize, 5*l.*, for his 15 months and 3 weeks-old (pure-bred Exmoor); bred by himself.

James Merson: the *Reserved Number*, to his 16 months and 1 week-old (pure Exmoor); bred by himself.

Jonathan Peel, Knowlmere Manor, Clitheroe, Yorkshire: First Prize, 15*l.*, for his 7 years and 3 months-old "Mountain King" (pure Lonk); bred by W. Widdup, Hould Top, Silsden, Yorkshire.

JONATHAN PEEL: Second Prize, 10*l.*, for his 4 years 3 months and 1 week-old "Son of the Mountain King" (pure Lonk); bred by James Duerden, Marsden, Colne, Lancashire; sire, "Mountain King."

JAMES QUARTLY, Molland House, South Molton, Devon: Third Prize, 5*l.*, for his 3 years 4 months and 2 weeks-old (pure Exmoor); bred by Philip Halse, Molland.

JAMES MERSON: the *Reserved Number*, to his 2 years and 4 months-old (pure-bred Exmoor); bred by himself.

Mountain Ewes—Pens of five.

JONATHAN PEEL: First Prize, 15*l.*, for his 1 year 2 months and about 3 weeks-old "Mountain Queens Nos. 41, 42, 45, 48, 50 (pure Lonk); bred by himself; sire, "Mountain King."

THE HONOURABLE COLONEL PENNANT, M.P., Penrhyn Castle, Bangor, Carnarvon: Second Prize, 10*l.*, for his 15 months-old (Cheviot); bred by himself.

JAMES QUARTLY: Third Prize, 5*l.*, for his 15 months-old (pure Exmoor); bred by himself.

RICHARD EASTWOOD: the *Reserved Number*, to his 15 months-old (Mountain); bred by Mrs. Green.

PRIZES GIVEN BY THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

Blackfaced Tups.

GAVIN SANDILANDS, North Cumberhead, Lesmahagan, Lanark: First Prize, 10*l.*, for his 4 years 2 months and 1 week-old; bred by himself.

JAMES DRIFE, Barr, Sanquhar, Dumfries: Second Prize, 5*l.*, for his 2 years and 2 months-old "Donald;" bred by David Toyer, Knowchead, Campsie, Stirling.

ROBERT ELLIOTT, Laighwood, Dunkeld, Perthshire: Third Prize, SILVER MEDAL, for his nearly 2 years and 2 months-old; bred by himself.

JAMES DRIFE: the *Reserved Number*, to his 2 years and 2 months-old "Campsie;" bred by David Toyer.

JAMES DRIFE: First Prize, 10*l.*, for his 14 months-old "The Ayrshire Laddie;" bred by Captain Kennedy, of Glenapp, Ballantrae, Ayr.

JAMES DRIFE: Second Prize, 5*l.*, for his 14 months-old "Bob;" bred by himself.

JOHN MALCOLM, Poltalloch: Third Prize, SILVER MEDAL, for his 15 months-old; bred by himself.

JAMES DRIFE: the *Reserved Number*, to his 14 months-old "Baldie;" bred by David Toyer.

Blackfaced Ewes—Pens of five.

ALLAN POLLOK, Ronachan, Clachan, Cantire, Argyll, First Prize, 8*l.*, for his two 3 years 2½ months and three 2 years 2½ months-old; bred by himself.

JAMES DRIFE: Second Prize, 4*l*., for his 3 years and 2 months-old "The Nithsdale Beauties;" bred by himself.

SAMUEL NEWALL, Eastby, Skipton, Yorkshire: Third Prize, SILVER MEDAL, for his 4 years and 3 months-old.

JAMES DRIFE: First Prize, 8*l*., for his 14 months-old "The Yochan Pets;" bred by himself.

ALEXANDER CAMPBELL, Auchindarroch, Lochgilphead, Argyll: Second Prize, 4*l*., for his 15 months-old; bred by himself.

GAVIN SANDILANDS: Third Prize, SILVER MEDAL, for his 14 months and 1 or 2 weeks-old; bred by himself.

ROBERT ELLIOTT: the *Reserved Number*, to his about 14 months old; bred by himself.

Cheviot Tups.

THOMAS BRYDON, Kinnethead, Moffat, Dumfriesshire: First Prize, 10*l*., for his 2 years 2 months and 3 weeks-old; bred by himself.

JAMES BRYDON, Moodlaw, Langholme, Dumfries: Second Prize, 5*l*., for his 3 years 2 months and 2 weeks-old; bred by himself.

THOMAS CHALMERS BORTHWICK, Hopsrig, Langholme, Dumfries: Third Prize, SILVER MEDAL, for his 3 years 2 months and 2 weeks-old; bred by himself.

THOMAS CHALMERS BORTHWICK: the *Reserved Number*, to his 2 years 2 months and 2 weeks-old; bred by himself.

WILLIAM GRAHAM HUNTER, Dumfedling, Langholme, Dumfriesshire: First Prize, 10*l*., for his 14 months and 8 days-old; bred by himself.

ROBERT BORLAND, Auchincairn, Closeburn, Thornhill, Dumfries: Second Prize, 5*l*., for his 14 months-old; bred by himself.

WILLIAM GRAHAM HUNTER: Third Prize, SILVER MEDAL, for his 14 months and 9 days-old; bred by himself.

ROBERT BORLAND: the *Reserved Number*, to his 14 months-old; bred by himself.

Cheviot Ewes—Pens of five.

THOMAS CHALMERS BORTHWICK: First Prize, 8*l*., for his 2 and 3 years 2 months and 2 weeks-old; bred by himself.

THE HON. COLONEL PENNANT, M.P.: Second Prize, 4*l*., for his two 4 years 3 months and two 3 years 3 months-old and one 2 years and 3 months-old; bred by himself.

ROBERT BORTAND: First Prize, 8*l*., for his 14 months-old; bred by himself.

THOMAS CHALMERS BORTHWICK: Second Prize, 4*l*., for his 14 months and 2 weeks-old; bred by himself.

SIR GRAHAM GRAHAM MONTGOMERY, BART., M.P., Stobo Castle, Peebles: Third Prize, SILVER MEDAL, for his about 14 months and 2 weeks-old; bred by himself; sire, "Capplegill."

THOMAS CHALMERS BORTHWICK: the *Reserved Number*, to his 14 months and 2 weeks-old; bred by himself.

PIGS.

Large Breed Boars.

JOHN DYSON, Adelphi Hotel, Dock Street, Leeds, Yorkshire: First Prize, 10*l.*, for his 1 year 7 months 3 weeks and 6 days-old, white with spots; bred by himself; sire, "Billy Bradley;" dam, "Lady."

JOHN HICKMAN, West Parade, Spring Bank, Hull: Second Prize, 5*l.*, for his about 3 years and 1 month-old "Garibaldi," white; bred by John Palmer; sire, "Young Hector;" sire of dam, "Old Duke."

WILLIAM BRADLEY WAINMAN, Carhead Cross Hills, Yorkshire: the *Reserved Number*, to his about 2 years 7 months and 2 weeks-old "Flag of Truce," white (Yorkshire.)

Small White Breed Boars.

MICHAEL GAVINS, The Fox Inn, Woodhouse Carr, Leeds: First Prize, 10*l.*, for his 1 year 1 month and 23 days-old "Roger Bacon;" bred by himself; sire, Lord Wenlock's "Cato;" dam, "Windsor Lass."

GEORGE MANGLES, Givendale, Ripon, Yorkshire: Second Prize, 5*l.*, for his 1 year and 2 weeks-old "Prizetaker," white (Yorkshire and Cumberland); bred by himself; sire, "Diamond;" dam, "Princess."

GEORGE MANGLES: the *Reserved Number*, to his 9 months-old "Lottery," white (Yorkshire and Cumberland); bred by himself; sire, "Diamond;" dam, "Beauty."

Small Black Breed Boars.

GEORGE MUMFORD SEXTON, Wherstead Hall, Ipswich, Suffolk: First Prize, 10*l.*, for his 1 year 2 months and 13 days-old "Chaff" (Improved Suffolk); bred by himself; sire, "Terror;" dam, "Canterbury Lass the 1st."

THOMAS CRISP, Butley Abbey, Wickham-Market, Suffolk: Second Prize, 5*l.* for his 1 year and 2 days-old (Improved Suffolk); bred by himself.

GEORGE MUMFORD SEXTON: the *Reserved Number*, to his 1 year and 1 day-old "Clear the Way" (Improved Suffolk); bred by himself: sire, "The Giant;" dam, sister to "Negress."

Berkshire Boars.

THE LATE SIR ROBERT GEORGE THROCKMORTON, BART.: First Prize, 10*l.*, for his 1 year 10 months and 1 week-old "Lablache;" bred by John Mitchell, Iver Lodge, Uxbridge, Middlesex; sire, "Buckland Boy;" dam, "Jenny Lind."

WILLIAM HEWER, Sevenhampton, Highworth, Wilts: Second Prize, 5*l.*, for his 1 year 2 months and 2 weeks-old; bred by himself; sire, "Uncle Tom;" dam, "Ruth."

REV. HENRY G. BAILY, Swindon, Wilts: the *Reserved Number*, to his 2 years 5 months and 25 days-old "King of Gloucester;" bred by himself; sire, "King of Warwick;" dam, "Rival."

Boars not eligible for the preceding Classes.

JOHN PARKINSON, Girlington Cottage, Bradford, Yorkshire: First Prize, 10*l.*, for his 7 months and 2 weeks-old "Roger," white (Yorkshire); bred by himself; sire, "Victory;" dam, "Lucy."

William Bradley Wainman: Second Prize, 5*l.*, for his 11 months and 19 days-old "Pipe of Peace," white (Yorkshire Middle); bred by himself.

George Chapman, Seamer, Scarborough, Yorkshire: the *Reserved Number*, to his 1 year 8 months and 16 days-old "Yorkshireman," white and black; bred by J. Donkin, North Grimston, Malton, Yorkshire; sire, "Ajax."

Large Breeding Sows.

William Bradley Wainman: First Prize, 10*l.*, for his about 3 years-old "Bright Hope," white (Yorkshire).

Edward Harrison, Woodhouse Moor, Leeds: Second Prize, 5*l.*, for his 2 years 8 months and 2 weeks-old "Leeds Lass," white; bred by Thomas Barker, Woodhouse Lane, Leeds; sire, "Wharfedale Lad;" dam, "Miss Havelock."

Small White Breeding Sows.

William Bradley Wainman: First Prize, 10*l.*, for his 1 year 3 months and 26 days-old "Silver Wing" (Yorkshire); bred by himself.

Samuel Geater Stearn, Brandeston, Wickham Market, Suffolk: Second Prize, 5*l.*, for his 2 years and 6 days-old "Victoria" (Suffolk); bred by himself; sire, "Duke;" dam, "Duchess."

George Edward Taylor, Oatlands, Leeds: the *Reserved Number*, to his 1 year and 1 week-old "Young Dewdrop;" bred by Robert Topling, Black Grove Terrace, Leeds; sire, "Hero;" dam, "Jenny."

Small Black Breeding Sows.

George Mumford Sexton: First Prize, 10*l.*, for his 1 year 1 month and 8 days-old "Negress 2nd" (Improved Suffolk); bred by himself; sire, "Negro;" dam, "Negress."

George Mumford Sexton: Second Prize, 5*l.*, for his 1 year 2 months and 13 days-old "Bumptious" (Improved Suffolk); bred by himself; sire, "Terror;" dam, "Canterbury Lass 1st."

Samuel Wolton, Kesgrave, Woodbridge, Suffolk: the *Reserved Number*, to his about 4 years and 8 months-old "Miss Northy" (Improved Suffolk); bred by himself; sire, "Negro;" dam, "Pug."

Berkshire Breeding Sows.

The late Sir R. G. Throckmorton, Bart.: First Prize, 10*l.*, for his 4 years 10 months and 1 week-old "Favourite 2nd;" bred by himself; sire, "Sir Robert;" dam, "Favourite."

William James Sadler, Bentham Calcutt, Cricklade, Wilts: Second Prize, 5*l.*, for his 2 years 3 months and 8 days-old "Bracebridge the Third;" bred by himself; sire, "Ermington;" dam, "Nightingale."

Royal Agricultural College, Cirencester, Gloucestershire: the *Reserved Number*, to their 11 months and 10 days-old; bred by themselves.

Breeding Sows, not eligible for the preceding Classes.

William Bradley Wainman: First Prize, 10*l.*, for his 2 years 3 months and 2 days-old "The Missing Link," white (Yorkshire middle breed); bred by himself.

William Bradley Wainman: Second Prize, 5*l.*, for his about 2 years and 4 months-old "Craven Belle;" white (Yorkshire middle breed); bred by John Birkbeck, Threapland House, Skipton-in-Craven, Yorkshire.

William Eardley, Larkton Hall, Malpas, Cheshire: the *Reserved Number*, to his 2 years 9 months and 26 days-old, white with a little blue (Cheshire middle breed); bred by Thomas Teasdale.

Large Breeding Sow Pigs—Pens of Three.

William Bradley Wainman: First Prize, 10*l.*, for his 7 months and 26 days-old white (Yorkshire); bred by himself.

John Hickman: Second Prize, 5*l.*, for his 7 months and 22 days-old "Nancy," "Blink Bonny," "Virago," white (improved); bred by himself; sire, "Garibaldi;" dam, "Miss Nightingale."

Small White Breeding Sow Pigs—Pens of Three.

Lord Wenlock, Escrick Park, Yorkshire: First Prize, 10*l.*, for his 7 months-old; bred by himself; sire, "Cumberland;" dam, "Antias."

Lord Wenlock: Second Prize, 5*l.*, for his 7 months and 3 weeks-old; bred by himself; sire, "Cumberland;" dam, "Princess."

The Hon. Colonel Hood: the *Reserved Number* to his 7 months and 2 weeks-old "Sophy," "Ann," "Jane," white; bred at H.R.H. the Prince Consort's Shaw Farm, Windsor; sire, "Buckland;" dam, "Mayflower."

Small Black Breeding Sow Pigs—Pens of Three.

George Mumford Sexton: First Prize, 10*l.*, for his 7 months and 9 days-old "Never-give-up" (Improved Suffolk); bred by himself; sire, "Terror;" dam, "Canterbury Lass."

Samuel Wolton: Second Prize, 5*l.*, for his 6 months and 1 week-old (Improved Suffolk); bred by himself; sire, "Napoleon;" dam, "The Paris Belle."

Berkshire Breeding Sow Pigs—Pens of Three.

The Rev. Henry G. Baily: First Prize, 10*l.*, for his 6 months and 29 days-old; bred by himself; sire, "Rival Boy;" dam, "Rival Princess."

Joseph Druce: Second Prize, 5*l.*, for his 7 months and 4 days-old; bred by himself.

William Hewer, Sevenhampton, Highworth, Wilts: the *Reserved Number*, to his 7 months and 2 weeks-old; bred by himself; sire, "Gipsy Boy the 15th;" dam, "Duchess of Dorchester."

Breeding Sow Pigs, not eligible for the preceding Classes, Pens of Three.

W. B. Wainman: First Prize, 10*l.*, for his 7 months and 13 days-old, white (Yorkshire middle breed); bred by himself.

Joseph Gledhill, High Street, Heckmondwike, Yorkshire: Second Prize, 5*l.*, for his 7 months and 2 days-old, white (middle breed); bred by himself; sire, "Volunteer;" dam, "Lady Kate."

George Chapman, Seamer, Scarborough, Yorkshire: the *Reserved Number*, to his 7 months and 20 days-old "The Three Lilies," white and blue (middle breed); bred by Edward Dickinson Nesfield, Scarborough; sire, "Yorkshireman."

FOREIGN CATTLE.

Charolaise Bulls.

Comte Charles de Bouillé, à Villars, Département de la Nièvre: First Prize, Gold Medal, for his 2 years 2 months and 19 days-old "France," white; bred by himself.

Charolaise Cows.

Comte Charles de Bouillé: First Prize, Gold Medal, for his 4 years 4 months and 2 weeks-old, white; bred by himself.

Comte Charles de Bouillé: the Grand Gold Medal, for the above Bull and Cow.

Garonnaise Bulls.

Henry Joseph Eluard, à Vert, St. Denis, de Seine-et-Marne: First Prize, Gold Medal, for his 3 years and 3 months-old, greyish brown; bred by M. Dardenne, au Château du Maurens, près Gimont, Gers, France.

Norman Bulls.

Giot (Parfait, Ainé), Chevry, Cossigny, Seine-et-Marne: First Prize, Gold Medal, for his 2 years and 1 week-old, roan; bred by himself.

Henry Joseph Eluard: Third Prize, Bronze Medal, for his 2 years 9 months and 2 days-old, roan; bred by M. Chartier, à Annette (Seine-et-Marne).

Norman Cows.

Giot (Parfait, Ainé): First Prize, Gold Medal, for his 5 years and 2 months-old; bred by M. Goussard Dives (Eure-et-Loir).

Henry Joseph Eluard: Second Prize, Silver Medal, for his 5 years 1 month and 2 days-old; bred by himself.

Giot (Parfait, Ainé): Third Prize, Bronze Medal, for his 2 years 4 months 2 weeks and 3 days-old; bred by himself.

Pyrenean Bulls.

Henry Joseph Eluard: First Prize, Gold Medal, for his 2 years and 9 months-old (Bearnese Race Pyrenean); bred by Jean Serre, à St. Faust, Basses Pyrénées.

Henry Joseph Eluard: Third Prize, Bronze Medal, for his 1 year and 10 months-old (Pure Pyrenean); bred by Mr. Borie (Corneille), à Asson, département des Basses Pyrénées.

Breton Bulls.

Samuel Camfield Baker, Beaufort Street, King's Road, Chelsea, Middlesex: First Prize, Gold Medal, for his 4 years and 2 months-old "Prince," black and white.

Giot (Parfait, Ainé): Second Prize, Silver Medal, for his 2 years 9 months and 16 days-old, black and white; bred by himself.

S. A. Madame la Princesse Baciocchi, of Korn-er-houêt, Morbihan, France: Third Prize, Bronze Medal, for her 1 year and 3 months-old, black and white; bred by herself.

Breton Cows.

Giot (Parfait, Ainé): First Prize, Gold Medal, for his 2 years 11 months and 12 days-old, white and roan; bred by himself.

S. A. Madame la Princesse Baciocchi: Second Prize, Silver Medal, for her 4 years-old, black and white; bred by le Comte de Labourdonnaie, à Coesandre, Grand Champ.

Henry Joseph Eluard: Third Prize, Bronze Medal, for his 5 years 1 month and 10 days-old, black and white; bred by M. Daudigné, à Muzillac, Morbihan, France.

Other French Breed Bulls.

Giot (Parfait, Ainé): First Prize, Gold Medal, for his 3 years and 8 months-old, pure (Franche-Comté); bred by Challes Grappe, Charmoilles (Haute-Saône).

Other French Breed Cows.

Giot (Parfait, Ainé): First Prize, Gold Medal, for his 3 years and 8 months-old, pure Fémeline (Franche-Comté); bred by Charles Grappe, Charmoilles (Haute-Saône).

Flemish Bulls.

Henri Mahieu, Tappelle les Dunkerque (Nord), France: First Prize, Gold Medal, for his 2 years and 4 months-old, red; bred by himself.

Flemish Cows.

Henri Mahieu: First Prize, Gold Medal, for his 3 years and 1 month-old, red; bred by himself.

Dutch Cows.

Giot (Parfait, Ainé): First Prize, Gold Medal, for his 2 years 1 month and 6 days-old, red and white; bred by himself.

Aarnoud Hendrik van Wickevoort Crommelin, Berkenrode, near Harlem, Holland: Second Prize, Silver Medal, for his 4 years 1 month and 17 days-old, black and white; bred by himself.

Swiss Bulls (Brown).

Forstand des Schweizerisehen, Bawernvereins, Schwyz: First Prize, Gold Medal, for his 2 years and 4 months-old (tall Swiss race) brown; bred by Johann Grossman, Alpthal, Canton Schwyz.

Brethern Schneider, St. Urbanhof, Gemeinde Sursee, Canton Luzern: Second Prize, Silver Medal, for his 1 year and 3 months-old (Swiss race), brown; bred by himself.

Heinrich Dolder, Feld Meilen, near Zürich: Third Prize, Bronze Medal, for his 2 years and 4 months-old, brown, tall and heavy; bred by Jacob Walder, Horgen.

Swiss Cows (Brown).

Franz Carl Mettler, Goldau, Canton Schwyz: First Prize, Gold Medal, for his 4 years-old (tall spotted race), brown; bred by Mr. Martin, at the Güzgren Yberg.

Heinrich Schmid, Gattikon Gemeinde, Thalweil, Canton of Zürich, Switzerland: Second Prize, Silver Medal, for his 4 years and 6 months-old, tall brown purest Swiss race; bred by Mr. Leonz Henggeler, in Unter Aegeri, Canton of Zug.

President of the Swiss Agricultural Society, Schwyz: Third Prize, Bronze Medal, for his 4 years and 3 months-old (tall Swiss race), light brown; bred by Clemens Gyr, in Einsiedeln, Canton of Schytz.

Swiss Bulls (Coloured).

Landwirthschaftliche Gesellschaft v. Simmenthal und Saanen (J. G. Karlen, Grossrath in Erlenbach, near Thun, Switzerland): First Prize, Gold Medal, for his 3 years 3 months and 24 days-old (tall speckled race of Simmenthal), red and white; bred by Johann Klossner, Latterbach, near Erlenbach, Berne, Switzerland.

Burry, Jean, Lussorf, Commune de Guin, Canton of Fribourg: Second Prize, Silver Medal, for his 4 years-old (Fribourg) spotted red and white; bred by Pierre Werro, at Raesch, Commune de Guin, Canton de Fribourg.

Adrien Ecoffey, Villars Sousmont, Canton of Fribourg: Third Prize, Bronze Medal, for his 2 years 1 month and 15 days-old (Fribourg speckled), spotted red; bred by himself.

Swiss Cows (Coloured).

Adrien Ecoffey: First Prize, Gold Medal, for his 5 years 3 months and 17 days-old (spotted Fribourg race), red and pale white; bred by Mr. Reichenbach at Gessenay.

Jean Fernand de Loyjs, de Treytorrens, Dorigny, près Lausanne, Canton de Vaud, Switzerland: Second Prize, Silver Medal, for his 3 years and 3 weeks-old (tall spotted race), red; bred by Mr. Lempen, at Betterier, Canton of Berne, Switzerland.

Jean Fernand de Loyjs: Third Prize, Bronze Medal, for his 3 years 8 months and 3 weeks-old (tall spotted race), red; bred by Jean Klooner, at Zweisimmen, Canton of Berne, Switzerland.

FOREIGN HORSES.

Heavy Draught Horses.

Desvaux Roze (agriculturist), at Courville, department of Eure-et-Loir. First Prize, Gold Medal, for his 4 years and 2 months-old stallion, "Empereur," pure Percheroune breed, greyish black, deeply marked on head; bred by himself.

FOREIGN SHEEP.

French Merino Rams.

Charles Lefebvre, St. Escobille, département de Seine-et-Oise: the Grand Gold Medal, and First Prize, Gold Medal, for his 3 years 6 months and 10 days-old; bred by himself.

Germain Victor Garnod, Genouilly, Crisenoy, département de Seine-et-Marne: Second Prize, Silver Medal, for his 2 years and 1 month-old; bred by himself.

Auguste Charles Louis Noblet, Château-Renard, arrondissement de Montargis, département du Loiret: Third Prize, Bronze Medal, for his 2 years 10 months and 1 week-old; bred by himself.

French Merino Ewes—Pens of Three.

Arsene Gatineau, Farm of Beau Français, Canton of Illiers, department of Eure-et-Loir: First Prize, Gold Medal, for his 4 years 6 months, 3 years 6 months 1 week, 4 years 6 months 2 weeks-old; bred by himself.

Germain Victor Garnod: Second Prize, Silver Medal, for his 1 year and 7 months-old; bred by himself.

Marin René Bailleau, Illiers, department of Eure-et-Loir: Third Prize, Bronze Medal, for his 2 years 7 months and 10 days-old; bred by himself.

Spanish Merino Rams.

Christian Carl Suntheim, Niedergandern, near Gottingen, in Hanover: First Prize, Gold Medal, for his 1 year-old; bred by M. Edward Kunitz, Dresden.

Christian Carl Suntheim: Second Prize, Silver Medal, for his 11 months and 20 days-old; bred by M. Edward Kunitz, Dresden.

Christian Carl Suntheim: Third Prize, Bronze Medal, for his 11 months and 5 days-old; bred by M. Edward Kunitz, Dresden.

Spanish Merino Ewes—Pens of Three.

Frederick Homeyer, Ranzin, near Mokow, Pomerania: First Prize, Gold Medal, for his 2 years and 2 months-old; bred by himself.

Frederick Homeyer: Second Prize, Silver Medal, for his 2 years and 2 months-old; bred by himself.

Christian Carl Suntheim: Third Prize, Bronze Medal, for his 4 years, 2 years 11 months 23 days, 2 years 9 months 19 days-old; bred by M. Edward Kunitz, director of the Schaferei, Dresden.

Saxony Merino Rams.

Carl August Gadegast, Thal, near Oschatz, Saxony: the Grand Gold Medal, and First Prize, Gold Medal, for his 3 years 2 months and 6 days-old; bred by himself.

Heinrich Adolph Steiger, Leutewitz and Lothayn, near Meissen: Second Prize, Silver Medal, for his 2 years 3 months and 1 day-old; bred by himself.

Saxony Merino Ewes—Pens of Three.

Heinrich Adolph Steiger; First Prize, Gold Medal, for his 2 years 2 months 16 days, 2 years 1 month 22 days, 2 years 2 months 13 days-old; bred by himself.

Carl August Gadegast: Second Prize, Silver Medal, for his 2 years 2 months 16 days, 1 year 2 months 10 days, 1 year 2 months 18 days-old; bred by himself.

Long-Woolled Rams.

Giot (Parfait, Ainé): First Prize, Gold Medal, for his 2 years and 5 months-old (Soyeuse de Mauchamp); bred by M. Lefevre, Geviolles (Côte d'Or).

Short-Woolled Rams, not qualified for the above Classes.

ACCLIMATISATION SOCIETY, 3, Duke Street, Adelphi, W.C.: BRONZE MEDAL, for their Chinese, age unknown.

Short-Woolled Ewes, not qualified for the above Classes—Pens of Three.

ACCLIMATISATION SOCIETY, 3, Duke Street, Adelphi, W.C.: BRONZE MEDAL, for their Chinese, age unknown.

Cross-bred Merino Rams.

GIOT (PARFAIT, Ainé): First Prize, GOLD MEDAL, for his 2 years 5 months and 1 week-old; bred by Godin, Ainé, Chatillon-sur-Seine, Côte d'Or.

PIERRE NICOLAS GODIN, Ainé, Chatillon-sur-Seine, Côte d'Or: Second Prize, SILVER MEDAL, for his 4 years 3 months and 10 days-old; bred by himself.

GIOT (PARFAIT, Ainé): Third Prize, BRONZE MEDAL, for his 2 years 5 months and 1 week-old; bred by Japiot-Coton, Chatillon-sur-Seine, Côte d'Or.

Cross-bred Merino Ewes—Pens of Three.

PIERRE NICOLAS GODIN, Ainé: First Prize, GOLD MEDAL, for his 2 years and 6 months-old; bred by himself.

PIERRE NICOLAS GODIN, Ainé: Second Prize, SILVER MEDAL, for his 2 years 6 months and 12 days-old: bred by himself.

PIERRE NICOLAS GODIN, Ainé: Third Prize, BRONZE MEDAL, for his 1 year and 6 months-old; bred by himself.

FOREIGN PIGS.

HENRY JOSEPH ELUARD: SILVER MEDAL, for his 1 year 2 months and 5 days-old (Craonnais boar): bred by Mr. De la Devansaye, à la Devansaye, Maine-et-Loire.

Essays and Reports.—PRIZES FOR 1863.—All Prizes of the Royal Agricultural Society of England are open to general competition. Competitors will be expected to consider and discuss the heads enumerated.

I. AGRICULTURE OF STAFFORDSHIRE.

FIFTY SOVEREIGNS will be given for the best Report on the Agriculture of Staffordshire.

The principal geological and physical features of the county should be described; the nature of the Soil and character of the Farming in its different districts or natural divisions; its Live Stock; Implements; recent changes of Farm Management; Improvements lately introduced and still required; remarkable or characteristic Farms; the influences exercised by neighbouring mines and factories on the cropping of the soil, the value of land, the rate of prices and wages, and on the demand for timber, and consequently on the profitable management of woods and plantations.

II. BREEDING OF HUNTERS AND ROADSTERS.

TWENTY-FIVE SOVEREIGNS will be given for an approved Essay on the Breeding of Hunters and Roadsters.

III. RESULTS OF STEAM CULTIVATION.

TWENTY-FIVE SOVEREIGNS will be given for the best Essay on the Results of Steam Cultivation.

The following points must be considered:—

1. *The Percolation of Water:*
   Whether a more rapid escape of surface water on strong soils has been observed.
2. *Texture of the soil:*
   Whether a deeper and more perfect tilth has been obtained.

3. *Crops:*

Crops:

Whether the produce has been increased.

The total amount of work done in a season; the number of days in which the tackle has been in use, the nature of the accidents and stoppages which have occurred, and the cost of ordinary repairs, breakages and improvements in the tackle should be stated.

IV. RECLAIMING OF WASTE LANDS.

TWENTY-FIVE SOVEREIGNS will be given for the best Report on the Reclaiming of Waste Lands.

The works described must have been executed in England or Wales within the last ten years. The nature of the soil and climate, the plan and cost of drainage, clearing or grubbing, marling, fencing, roadmaking; the crops grown, and the course of culture and management to be pursued, should be stated.

V. MOVEABLE FENCING FOR SHEEP.

TEN SOVEREIGNS will be given for the best Essay on Moveable Fencing for Sheep.

The cost, durability, and convenience of hurdles of various kinds; of portable fencing, wood or iron; and of nets of various materials and meshes, painted or not, should be contrasted.

VI. DESTRUCTION OF INSECTS INJURIOUS TO AGRICULTURE.

TWENTY SOVEREIGNS will be given for the best Essay on the Destruction of Insects Injurious to Agriculture.

The Essay may specially apply either to the insects which injure the Cereals, or to those which destroy the Root Crops. References to former treatises describing the nature of these insects should be brief, with special regard to the course of action to be pursued.

VII. TREATMENT OF LAND DAMAGED BY SALT WATER.

FIFTEEN SOVEREIGNS will be given for an approved Essay on the Treatment of Land Damaged by the overflow of Salt Water.

VIII. ANY OTHER AGRICULTURAL SUBJECT.

TEN SOVEREIGNS will be given for an approved Essay on any other Agricultural Subject.

Reports or Essays competing for the Prizes must be sent to the Secretary of the Society, at 12, *Hanover Square, London, on or before March* 1, 1863. *Contributors of Papers are requested to retain Copies of their Communications, as the Society cannot be responsible for their return.*

RULES OF COMPETITION FOR PRIZE ESSAYS.

1. All information contained in Prize Essays shall be founded on experience or observation, and not on simple reference to books or other sources. Competitors are requested to use foolscap or large letter paper, and not to write on both sides of the leaf.

2. Drawings, specimens, or models, drawn or constructed to a stated scale, shall accompany writings requiring them.

3. All competitors shall enclose their names and addresses in a sealed cover, on which only their motto, the subject of their Essay, and the number of that subject in the Prize List of the Society, shall be written.*

4. The President or Chairman of the Council for the time being shall open the cover on which the motto designating the Essay to which the Prize has been awarded is written, and shall declare the name of the author.

5. The Chairman of the Journal Committee shall alone be empowered to open the motto-paper of any Essay not obtaining the Prize, that he may think likely to be useful for the Society's objects; with a view of consulting the writer confidentially as to his willingness to place such Essay at the disposal of the Journal Committee.

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* Competitors are requested to write their motto on the enclosed paper on which their names are written, as well as on the outside of the envelope.

6. The copyright of all Essays gaining Prizes shall belong to the Society, who shall accordingly have the power to publish the whole or any part of such Essays; and the other Essays will be returned on the application of the writers; but the Society do not make themselves responsible for their loss.

7. The Society are not bound to award a prize unless they consider one of the Essays deserving of it.

8. In all reports of experiments the expenses shall be accurately detailed.

9. The imperial weights and measures only are those by which calculations are to be made.

10. No prize shall be given for any Essay which has been already in print.

11. Prizes may be taken in money or plate, at the option of the successful candidate.

12. All Essays must be addressed to the Secretary, at the house of the Society, on or before the 1st of March, 1863.

Members' Privileges of Chemical Analysis.

The Council have fixed the following rates of Charge for Analyses to be made by the Consulting Chemist for the *bonâ-fide* use of Members of the Society; who (to avoid all unnecessary correspondence) are particularly requested, when applying to him, to mention the kind of analysis they require, and to quote its number in the subjoined schedule. The charge for analysis, together with the carriage of the specimens, must be paid to him by members at the time of their application.

No. 1.—An opinion of the genuineness of Peruvian guano, bone-dust, or oil-cake (each sample)	5s.
,, 2.—An analysis of guano; showing the proportion of moisture, organic matter, sand, phosphate of lime, alkaline salts, and ammonia	10s.
,, 3.—An estimate of the value (relatively to the average of samples in the market) of sulphate and muriate of ammonia, and of the nitrates of potash and soda	10s.
,, 4.—An analysis of superphosphate of lime for soluble phosphates only	10s.
,, 5.—An analysis of superphosphate of lime, showing the proportions of moisture, organic matter, sand, soluble and insoluble phosphates, sulphate of lime, and ammonia ..	£1.
,, 6.—An analysis (sufficient for the determination of its agricultural value) of any ordinary artificial manure	£1.
,, 7.—Limestone:—the proportion of lime, 7s. 6d.; the proportion of magnesia, 10s.; the proportion of lime and magnesia	15s.
,, 8.—Limestone or marls, including carbonate, phosphate, and sulphate of lime, and magnesia with sand and clay ..	£1.
,, 9.—Partial analysis of a soil, including determinations of clay, sand, organic matter, and carbonate of lime	£1.
,, 10.—Complete analysis of a soil	£3.
,, 11.—An analysis of oil-cake, or other substance used for feeding purposes; showing the proportion of moisture, oil, mineral matter, albuminous matter, and woody fibre; as well as of starch, gum, and sugar, in the aggregate	£1.
,, 12.—Analyses of any vegetable product	£1.
,, 13.—Analyses of animal products, refuse substances used for manure, &c.	from 10s. to 30s.
,, 14.—Determination of the "hardness" of a sample of water before and after boiling	10s.
,, 15.—Analysis of water of land drainage, and of water used for irrigation	£2.
,, 16.—Determination of nitric acid in a sample of water	£1.

N.B.—*The above Scale of Charges is not applicable to the case of persons commercially engaged in the Manufacture or Sale of any Substance sent for Analysis.*

The Address of the Consulting Chemist of the Society is, Dr. Augustus Voelcker, Cirencester, Gloucestershire, to which he requests that all letters and parcels (postage and carriage paid) should be directed: for the convenience, however, of persons residing in London, parcels sent to the Society's Office, No. 12, Hanover Square, W., will be forwarded to Cirencester once or twice a week.

Members' Veterinary Privileges.

I.—Serious or Extensive Diseases.

No. 1. Any Member of the Society who may desire professional attendance and special advice in cases of serious or extensive disease among his cattle, sheep, or pigs, and will address a letter to the Secretary, will, by return of post, receive a reply stating whether it be considered necessary that Professor Simonds, the Society's Veterinary Inspector, should visit the place where the disease prevails.

No. 2. The remuneration of the Inspector will be 2*l.* 2*s.* each day as a professional fee, and 1*l.* 1*s.* each day for personal expenses; and he will also be allowed to charge the cost of travelling to and from the locality where his services may have been required. The fees will be paid by the Society, but the travelling expenses will be a charge against the applicant. This charge may, however, be reduced or remitted altogether at the discretion of the Council, on such step being recommended to them by the Veterinary Committee.

No. 3. The Inspector, on his return from visiting the diseased stock, will report to the Committee, in writing, the results of his observations and proceedings, which Report will be laid before the Council.

No. 4. When contingencies arise to prevent a personal discharge of the duties confided to the Inspector, he may, subject to the approval of the Committee, name some competent professional person to act in his stead, who shall receive the same rates of remuneration.

II.—Ordinary or Other Cases of Disease.

Members may obtain the attendance of the Veterinary Inspector on any case of disease by paying the cost of his visit, which will be at the following rate, viz., 2*l.* 2*s.* per diem, and travelling expenses.

III.—Consultations without visit.

Personal consultation with Veterinary Inspector	5*s.*
Consultation by letter	5*s.*
Consultation necessitating the writing of three or more letters.	10*s.*
Post-mortem examination, and report thereon	10*s.*

A return of the number of applications during each half-year being required from the Veterinary Inspector.

IV.—Admission of Diseased Animals to the Veterinary College; Investigations, Lectures, and Reports.

No. 1. All Members of the Society have the privilege of sending cattle, sheep, and pigs to the Infirmary of the Royal Veterinary College, on the same terms as if they were Members of the College; viz., by paying for the keep and treatment of cattle 10*s.* 6*d.* per week each animal, and for sheep and pigs "a small proportionate charge to be fixed by the Principal according to circumstances."

No. 2. The College has also undertaken to investigate such particular classes of disease, or special subjects connected with the application of the Veterinary art to cattle, sheep, and pigs, as may be directed by the Council.

No. 3. In addition to the increased number of lectures now given by Professor Simonds—the Lecturer on Cattle Pathology—to the pupils in the Royal Veterinary College, he will also deliver such lectures before the Members of the Society, at their house in Hanover Square, as the Council shall decide.

No. 4. The Royal Veterinary College will from time to time furnish to the Council a detailed Report of the cases of cattle, sheep, and pigs treated in the Infirmary.

GOVERNORS AND MEMBERS

OF THE

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

1862.

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

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†Fuller, Francis...21, Parliament Street, S.W.

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Hamond, Anthony...Westacre Hall, Brandon
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Hayter, Right Hon. Sir Wm. Goodenough, Bart., M.P....Stowberry Park, Wells, Somersetshire
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†Heywood, Thomas Percival...Claremont, Manchester
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†Hoghton, Henry...Bold Hall, Warrington
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Hood, Hon. Col. A. Nelson...Cumberland Lodge, Windsor
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†Hulse, Col. Sir Edward, Bart....Breamore House, Fordingbridge, Hampshire
†Hunt, Zachary D....Aylesbury

Johnstone, Sir John V. B., Bart., M.P....Hackness Hall, Scarborough

Kerrison, Sir Edward Clarence, Bart., M.P....140, Piccadilly, W.
†Knight, Frederick Winn, M.P....Wolverley House, Kidderminster

Langston, J. Haughton, M.P....Sarsden House, Chipping Norton, Oxfordshire
Lansdowne, Marquis of, K.G....Bowood Park, Calne, Wiltshire
†Leconfield, Lord...Petworth House, Sussex
†Le Couteur, Colonel...Belle Vue, Jersey
Legh, William John...Lyme Park, Stockport
†Leicester, Earl of...Holkham Hall, Norfolk
†Leigh, Lord...Stoneleigh Abbey, Warwickshire
Lemon, Sir Charles, Bart....Carclew, Penrhyn, Cornwall
†Long, Walter, M.P....Rood Ashton, Trowbridge, Wilts
†Lonsdale, Earl of...Lowther Castle, Penrith
Lovelace, Earl of...East Horsley, Ripley, Surrey

Marlborough, Duke of...Blenheim Park, Oxon
†Marshall, William, M.P....Pattendale Hall, Penrith
†Miles, Sir William, Bart., M.P....Leigh Court, Bristol, Somersetshire
Mills, Thomas...Tolmers, Hertford
Montefiore, J. M....Worth Park, Crawley
†Morrison, Alfred...Fonthill House, Hindon, Wilts
Murray, Charles Robert Scott...Danesfield, Marlow, Buckinghamshire

Naper, James Lennox William...Lough Crew, Old Castle, Ireland
†Northwick, Lord...Athenæum Club, S.W.

Palmer, Robert...Holme Park, Reading, Berkshire
Patten, Col. John Wilson, M.P....Bank Hall, Warrington, Lancashire
Pennant, Hon. Col. Edw. Gordon Douglas, M.P....Penrhyn Castle, Bangor
†Perkins, Algernon...Hanworth Park, Hounslow, W.
Pole, E. S. Chandos...Radbourne Hall, Derby
†Popham, Francis Leyborne...Littlecott, Hungerford, Berks
†Portman, Lord...Bryanston House, Blandford, Dorsetshire
†Powis, Earl of...Powis Castle, Welshpool

†Radnor, Earl of...Coleshill House, Highworth, Wilts
Ratcliff, Sir John, Knt....Wyddrington, Edgbaston, Birmingham
Rayleigh, Lord...Terling Place, Witham, Essex

Ridley, Sir Matthew White, Bart....Blagdon, Morpeth, Northumberland
Rigg, Jonathan...4, Chester Place, Hyde Park Square, W.
Robartes, Thos. J. Agar, M.P....Lanhydrock House, Bodmin
Rogerson, John...St. Alban's Villa, Highgate Rise, N.
†Rutland, Duke of...Belvoir Castle, Grantham

Saint Germans, Earl of...Port Eliot, Devonport
†Sanford, Edward Ayshford...Nynehead Court, Wellington, Somersetshire
†Scholey, William Stephenson...Lauriston, Larkhall Lane, Clapham, S.
†Shadwell, Lucas...Fairlight, Hastings
Shelley, Sir John Villiers, Bart., M.P....Maresfield Park, Uckfield, Sussex
Shrewsbury and Talbot, Earl of...Ingestre, Staffordshire
†Smith, John Abel...37, Chester Square, S.W.
†Sondes, Lord...Elmham Hall, Elmham, Norfolk
Sotheron-Estcourt, the Right Hon. Thomas H. S. B. E., M.P....Bowden Park, Chippenham
†Southampton, Lord...Whittlebury Lodge, Towcester
Stafford, Lord...Cotessy Hall, Norwich
Stanhope, John Spencer...Cannon Hall, Barnsley, Yorkshire
†Stradbroke, Earl of...Henham Park, Wangford, Suffolk
†Sutton, John Manners...Kelham, Newark, Notts

†Tanqueray, John Samuel...Hendon, Middlesex
Taunton, Lord...Stowey, Somersetshire
†Thompson, H. S., M.P....Kirby Hall, York
†Thorold, Sir John Charles, Bart....Syston Park, Grantham
†Torrington, Viscount...Yokes Court, Mereworth, Kent
Towneley, Lieut.-Col. Charles...Towneley, Burnley, Blackburn
†Tunno, Edward Rose...Warnford Park, Bishop's Waltham
Tuxford, George Parker...246, Strand, W.C.

Walsh, Sir John, Bart., M.P....Warfield Park, Bracknell, Berkshire
Walsingham, Lord...Merton Hall, Thetford, Norfolk
†Warner, Edward, M.P....Higham Hall, Woodford
†Warwick, Earl of...Warwick Castle, Warwick
Westminster, Marquis of, K.G....Motcombe House, Shaftesbury
†Whitbread, William Henry...Southhill House, Bedford
†Williams-Chancellor, the Rev. Sir Erasmus, Bart....Llanywormwood Park, Carmarthenshire
Wilmot, Edward Woollett...Buxton, Derbyshire
†Wilson, Fuller Maitland...Langham Hall, Bury St. Edmund's
†Wilson, Henry...Stowlangtoft Hall, Bury St. Edmund's
Wilshere, William...The Frythe, Welwyn
Wood, George...Hanger Hill, Ealing, W.
Wynn, Sir Watkin Williams, Bart., M.P....Wynnstay, Rhuabon, Denbighshire

Zetland, Earl of...Aske Hall, Richmond, Yorkshire

List of Members.

† Life Member's mark.

A.

†Abbey, George...Silsworth Lodge, Daventry
Abbey, John...The Grange, Wellingborough
Abbot, Chas. H....Bower, Long Ashton, Bristol
Abbott, Evelyn...Lowdham, Nottingham
†Abbott, Stephen, jun....Castleacre, Swaffham
Abbott, Wm...Hill Farm, Gt. Wigborough, Colchester
Abercorn, Marq. of..Chesterfield Ho., S. Audley St., W.
†Abergavenny, Earl of...Birling Manor, Maidstone
Abraham, Rev. T. E....Barton Place, Mildenhall
Abraham, Thomas...Dunster, Taunton
†Abrey, Thos. S. H....Witham, Essex
†Ackers, James...Prinknash Park, Painswick
Acland, Sir Pere. P. F. Palmer, Bart....Bridgewater
Acland, Thos. Dyke...Sprydoncote, Exeter
†Acworth, N. B....The Hook, Northaw, Middlesex
Ackroyd, William...Otley
†Adair, A...Heatherton Park, Wellington, Somerset
Adair, Sir R. Shafto, Bart....20A, St. James's Square
Adam, Alexander...Boulogne-sur-Mer
Adams, Capt. G. Curtis, R.N...Anstey Hall, Coventry
Adams, G. T....Hawkhurst, Kent
Adams, Thos....New House, Marden, Herefordshire
Adcock, William...Farmdish, Wellingborough
†Adderley, Rt. Hon. C. B., M.P..Hams Hall, Minworth
Adeane, Henry J., M.P...Babraham Pk., Cambridge
Adkins, George C. ...The Lightwoods, Birmingham
Adney, G....Harley, Much Wenlock
Adney, John...Rowton, Wellington, Salop
†Ahrens, E...New Schlagsdorf, Schwerin, Mecklenbg.
†Akroyd, Edward, M.P...Bank Field, Halifax
Alderman, Rev. F. C....Kintbury, Hungerford
Alderman, Robert...Farndish, Wellingborough
†Alderson, John...Thornby Villa, Wigton
Aldous, Robert...Burlingham, Norwich
Aldridge, Edward...Chippenham Court, Slough
†Aldworth, W., jun....Frilford, Abingdon
Alexander, Caledon...Sudbury
†Alexander, Edward...Leominster
†Alington, G. M....Swinhope House, Grimsby
Alison, John...Brightlands, Reigate
†Allcroft, J. D....Worcester
Allday, John...Griston, Watton, Norfolk
†Allen, B. Haigh...Longcrofts Hall, Lichfield
Allen, Chas. W....The Moor, Kington, Herefords.
Allen, Henry...Oakfield, Hay, Herefordshire
Allen, John R....Lyngford House, Taunton
Allen, Major Ralph S....Bathampton, Bath
Allen, Rev. Dr....Downham Market, Norfolk
Allen, Stephen H....Abbotts Ann, Andover
Allen, Thomas...Thurmaston, Leicester
Allen, Thomas...Upton Cottage, Macclesfield
Allen, W.T...Little Stambridge Hall, Rochford, Essex
Allenby, George...Hallington, Louth, Lincolnshire
†Allfrey, H.W...Hemingford Ho., Stratford-on-Avon
†Allfrey, Robert...Wakefield Park, Reading
Allender, G. M....Manor Farm, Quainton, Winslow
Allerton, George R....Barling, Rochford, Essex
Allington, Rev. J....Little Barford, St. Neot's, Hunts.
Allison, Wm. H. Bilby...East Retford
Allix, Charles...Willoughby Hall, Grantham
Allmett, John...Clapham, S.
Allsopp, Henry...Foremark Hall, Burton-on-Trent
†Ambler, Henry...Watkinson Hall, Halifax
Ames, John...Clevelands, Lyme, Dorset
Ames, George Henry...Cote House, Bristol
Ames, Lionel...The Hyde, St. Alban's
†Amhurst, W. A. T....Didlington Park, Brandon.
Amos, Charles E...Greenfield House, Sutton, S.
†Anderson, Alexander...
Anderson, David...10, Kenilworth Square, Dublin.
†Anderson, R....Grey Street, Newcastle-upon-Tyne
Anderson, Robert A....Cirencester
Anderton, G. jun....Howden Dyke, Howden, Yorks
Anderton, J....Cleckheaton, Leeds
Andrewes, C. J....Kate's Grove Iron-Works, Reading
Andrews, Charles...Harewood, Ross
Andrews, Henry...Wishford, Salisbury
Andrus, Francis...Scadbury, Southfleet, Gravesend
Angas, Wm....Neswick, Driffield
Angeworth, Wm....Eardington House, Bridgnorth
Ankers, Robert B....Huxley Green, Chester
†Annandale, P....Shotley Grove, Newcastle-on-Tyne
†Anson, Sir John, Bart....Avisford, Arundel
Anstey, Samuel...Monabilly Farm, Par Station
Anstice, J....Madeley Wood, Wellington
†Anstruther, J. H. L....Hintlesham Hall, Ipswich
†Anstruther, Sir R.A., Bt..Balcaskie, Leven, Fifeshire
†Aplin, Henry..Combe St. Nicholas, Chard, Somerset
†Appach, Reginald..Maytham Hall, Rolvenden, Kent
Appleby, T. Dawkins...Briggate, Leeds
†Applewhaite, Edward...Pickenham Hall, Swaffham
Araujo, Captain F. J. da Silva...Rio de Janeiro
†Arbuthnot, John A....Coworth, Chertsey, Surrey
Arbuthnot, W. U....Bridgen Place, Kent
†Arcedeckne, Andrew...Glevering Hall, Suffolk
Argent, John...Manor Farm, Egham
Arkcoll, Thomas...The Meads, Eastbourne
Arkell, H....Butlers' Ct., Boddington, Cheltenham

†Arkell, T....Pen Hill Farm, Swindon, Wilts
Arkell, Thomas...Boddington, Cheltenham
Arkwright, Rev. J....Mark Hall, Harlow, Essex
Arkwright, Peter...Willersby, Matlock, Derbyshire
Armitage, Arthur...Moraston, Ross, Herefordshire
Armstrong, G...Heddon-on-the-Wall, Northumb.
Armstrong, George...Thornton Heath, Surrey
Armstrong, H., M.D...Peckham Ho., Peckham, S.E.
Armstrong, John...Palterton, Chesterfield
Armstrong, Robert...Over Tabley, Knutsford
Armytage, Col. H..Broomhill Bank,Tonbridge Wells
Arnold, Lewin...Wilcot, Marlboro', Wilts
Arnold, Rev. Richard A....Ellough, Beccles
Arnot, James...Woodcote, Carshalton, S.
Arnould, Alfred Henry...Whitecross, Wallingford
Arthur, Lieut.-Col. C....Misterton Hall, Lutterworth
Ashby, T. W....Rutland Terrace, Stamford
Ashcroft, James...Cow Lane, Wavertree, Liverpool
Ashcroft, Thomas...Walford, Eccleshall, Staffs.
Ashdown, S. H....Uppington, Wellington, Salop
Ashhurst, John H....Waterstock, Oxford
Ashlin, John...Firsby, Spilsby
Ashton, G. F....Stormer Hill, Totlington, Bury
†Ashton, Henry...Woolton, Liverpool
†Ashton, T. Henry...
†Askew, Sir H....Pallinsburn Ho., Coldstream, N.B.
†Astbury, William...4, Munster Ter., Fulham, S.W.
Astley, F. D. R....Duckinfield, Ashton-under-Lyne
†Astley, F. L'Estrange...Melton Constable, Thetford
†Aston, Samuel...Bushwood Lodge, Warwick
†Atherton, Tho....Chapel House, Speke, Liverpool
†Athorpe, J. C....Dinnington Hall, Rotherham
Athreton, George T....Beech Cottage, Wrexham
Atkins, A. Edwin...Farnham Court, Slough, Bucks
Atkinson, Benj....Manston Lodge, Whitkirk, Leeds
Atkinson, E....Laurel Bank, Potternewton, Leeds
†Atkinson, James...Winderwath, Penrith
†Atkinson, J. H. H....Angerton, Morpeth
Atkinson, John...Charlton, Salisbury
†Atkinson, W....Gt. Rapers, Bures St. Mary's
Atkinson, W. S....Barrowby Hall, Whitkirk, Leeds
Atkinson, William...Ashton Heyes, Chester
†Atkinson, W. James...Marlow, Buckinghamshire
Attenborough, J. ...Brampton Ash, Market Harbro'
Attwater, J. Gay...Cubberley, Cheltenham
Aveland, Lord...Normanton Park, Stamford
Avery, Thomas Charles...Gloucester
Awbery, F. D....St. Lawrence Wootton, Basingstoke
Ayles, Stephen..Hall Pl. Farm, Braishfield, Romsey
†Aylesford, Earl of...Packington Hall, Coventry.
†Aylmer, H....West Dereham, Stoke Ferry, Norfolk
†Aylmer, J. B....Fincham Hall, Downham, Norfolk
Aylmer, John H....Walworth Castle, Darlington
†Aylmer, R. B....Westacre Abbey, Swaffham
†Aynsley, J. Murray...Underdown, Ledbury
†Aytoun, R. S....Inchdairnie, Kirkcaldie, N.B.

B.

†Babington, Chas. C., M.A...St. John's, Cambridge
†Back, John Alfred...Thorpe Hamlet, Norwich
Bacon, Rev. H....Baxterley Rectory, Atherstone
Bacon, James, Pluckley, Ashford, Kent
Bacon, Samuel, jun....Ratcliffe Culey, Atherstone
†Backhouse, Edmund...Polam Hill, Darlington
Badcock, Benjamin...Broad Street, Oxford
Badcock, Henry...Taunton
Badcock, P....36, Eastbourne Terr., Hyde Park, W.
Badger, W. H....Syerscote Manor, Tamworth
Badham, G. D....Bulmer, Sudbury
†Bagot, Rt. Hon. Lord...Blithefield, Rugeley, Staff.
Bagster, Benjamin...Watford
†Bailey, James...Nynehead, Wellington, Somerset
†Bailey, Wm....Hazling, Belford, Northumberland
†Baillie, Hamilton...Ash Hall, Cowbridge
Baillie, Wm. Hunter...4, Upper Harley Street
†Baillie, Evan...St. Austin's, Torquay
Baily, Rev. H. G....The Vicarage, Swindon
Baily, J., sen....113, Mount Street, Berkeley Square
Baily, T. F....Hall Place, Leigh, Tunbridge
Bainbrigge, W. H...Woodseat, Ashbourne, Derbysh.
Baines, F. W....Norfolk Farm, Windsor Great Park
Baker, Anne...Grendon, Atherstone
Baker, Benjamin Heath...Acle, Norwich
Baker, George W....Parknook, Quorndon, Derby
†Baker, Lake J....Hargrave, Kimbolton
Baker, James...Drayton Bassett, Tamworth
†Baker, John...
†Baker, Sir E. Baker, Bart...Ranston Ho., Blandford
†Baker, T. Barwick L...Hardwick Court, Gloucester
Baker, Thomas...Barton, Cambridge
Baker, William...Purewell House, Christchurch
†Baker, William H...Westington, Campden, Glouc.
Baldwin, B. F. ...The Ox Leasowes, Tardebigg
Baldwin, John...Luddington, Stratford-on-Avon
Balfour, D....Balfour Castle, Kirkwall, N.B.
Ball, Capt. Thomas...85, Stephen's Green, Dublin
†Balmer, Thomas...Fochabers, N.B.
Balston, Thomas...Chart Sutton, Staplehurst
Bancks, James...Prebendal House, Thame
Bancroft, William...Clifton Campvill, Tamworth
†Bankes, John Scott...Soughton Hall, Northop
Banks, Ed. R. R. G....Sholden Lodge, Deal
†Banks, John Jackson...Kendal
Banks, Wm. J...West Cliff, Dover
†Bannerman, Alexander...South Cottage, Chorley
†Bannerman, Henry...Hunton Court, Maidstone
Bannister, J. S...Weston, Pembridge, Herefordshire
Banwell, William...Little Marlow, Bucks
Barber, Miles...Barlborough, Chesterfield
Barber, S. W...Hayton Castle, Bawtry
†Barbour, George...Bolesworth Castle, Chester
†Barbour, R....Bolesworth Castle, Chester
Barchard, F....Horsted Place, Horsted, Uckfield
Baring, Hon. and Rev. F...Melchit Park, Salisbury
Baring, John...Oakwood, Chichester
†Barker, Edward...Ruddington, Notts
†Barker, G. I. Raymond...20, Royal Crescent, Bath
†Barker, H.B. Raymond...University Cl., Suffolk St.
Barker, H....Suffolk Fire Office, Bury St. Edmund's
Barker, J. H....Rowsley, Bakewell, Derbyshire
Barker, Walter R. H....Wantage
Barlow, F. ..The Shrubbery, Hasketon, Woodbridge
Barlow, Rev. P....Cockfield Rec., Staindrop, Darlingtn.
Barnard, Charles...Norwich
Barnard, Fulke Toovey...Albion Chambers, Bristol

Barnardiston, Nathaniel C....The Ryes, Sudbury
Barneby, J. Habington...Brockhampton, Worcester
†Barneby, William...Clater Park, Bromyard
Barnes, C....Chorley Wood House, Rickmansworth
Barnes, Ralph...Exeter
†Barnes, T....The Quinta, Chirk, N. Wales
Barnes, Thomas...Westland, Moynalty, co. Meath
†Barnett, Charles..Stratton Pk., Biggleswade, Beds.
Barnett, Henry...Glympton Park, Woodstock
Barnett, J....Remenham Hill, Henley-on-Thames
Barnett, R....Meopham Court, Gravesend
Barratt, John R....Maiden Hill, Penrith
Barrett, G. A....Kate's Grove Iron-Works, Reading
Barrett, John B....Milton House, Steventon, Berks
Barrington, Visc....Beckett House, Faringdon, Berks
Barrington, Wm....Thorley, Isle of Wight
Barroby, Miss Elizabeth...Dishforth, Thirsk
†Barrow, Chas. James...Southwell, Notts
†Barrow, John James...Normanton Hall, Southwell
†Barrow, Wm....Bilbrooke House, Wolverhampton
Barrs, T....Brompton Hall, Churchstoke, Salop
†Barstow, Charles D....Garrow Hill, York
Barter, Rev. C....Sarsden, Chipping Norton
Barter, George...Sarsden, Chipping Norton
Bartholomew, W....Goltho, Wragby, Lincolnshire
†Barthropp, N. G....Cretingham, Wickham Market
†Barton, Charles...Holbrook House, Wincanton
Barton, Gerard...Fundenhall, Wymondham
†Barton, Rev. H. N... St. Ervan Rectory, Padstow
†Barton, J. H....Stapleton Park, Pontefract
Barton, Richard...Caldy Manor, Birkenhead
†Barwell, Thomas...Leicester
Baskerville, H...Crawshay Park, Reading, Berks
Bass, Michael T., M.P....Burton-on-Trent
Bass, W....Duckenfield Lodge, Ashton-under-Lyne
Bassett, Richard...Bonvilstone, Cardiff
Bastard, T. Horlock...Charlton Marshall, Blandford
†Batard, T. M. Bearda...Ramsden Crays, Billericay
Bate, Edward...Kelsterton, Flintshire, N.W.
Bate, Samuel...Springfields, Newcastle-under-Lyme
†Bateman, Henry...Asthall, Witney, Oxfordshire
†Bates, George...Blaxhall Hall, Wickham Market
Bates, Thomas, jun....Eaton Green, Luton, Beds.
Bathurst, Earl...Cirencester, Gloucestershire
Bathurst, Hon. Wm. L....38, Half-Moon Street, W.
Bathurst, Lt.-Col., M.P...Clarendon Pk., Salisbury
†Batson, Thos....Combe House, Bath
Batt, William Henry...West Drayton, Uxbridge
Battcock, F...Hemingford Abbotts, St. Ives, Hunts
Batten, Abraham...Ayott St. Peter's, Welwyn, Herts
†Batten, John...Yeovil, Somersetshire
†Baxendale, J....Woodside, Whetstone, Middlesex
Baxendale, Richard B....Woodside, Whetstone, N.
Baxter, H. J...Cheadle, Cheshire
Baxter, Robert...Doncaster
†Bayden, Thomas...Hythe, Kent
Bayes, Charles...Kettering
Bayley, Daniel (Captain)...Tallaght, co. Dublin
Bayley, Thomas...Lenton, Nottingham
Bayley, William...Britwell Farm, Maidenhead
Bayne, William...High Street, Oxford
Bayning, Rt.Hon.&Rev. Ld...Honingham Hall, Norf.
Bayzand, Joseph...Kingley Arrow, Alcester

Beach, Joseph...Flour Mill, Dudley
†Beach, Sir M. E. H., Bt...Williamstrip Pk., Fairford
†Beadel, James...Broomfield Lodge, Chelmsford
Beadel, Wm. James...Chelmsford
Beadon, Rev. F....North Stoneham Rectory, Hants
Beale, E. T....237, High Holborn, W.C.
†Beale, William...Larkins Farm, Chiddingstone
†Bean, Alf. W....Castle Ho., Shooter's Hill, Kent
†Bearcroft, E....Mere Hall, Droitwich, Worcestersh.
Beard, John...Linton, Burton-on-Trent
Beard, W....Tormarton, Cross Hands, Cirencester
Beards, Thomas...Stowe Park, Buckingham
Bearn, William...Finedon Hill, Higham Ferrers
†Beart, Robert...Godmanchester, Huntingdonshire
Beaseley, John...Brampton, Northampton
†Beattie, James...Newbie House, Annan, N.B.
Beauchamp, Chas. D....23, Upper Seymour St., W.
†Beauchamp, Earl...Madresfield Court, Worcester
Beauchamp, Sir T. W. B., Bt...Langley Hl., Norwich
Beaumont, E. B....Woodhall, Barnsley, Yorkshire
Beaumont, Francis H....Buckland Court, Reigate
†Beaumont, Geo., jun....Bridgeford Hill, Notts.
†Beaumont, J. A....Park House, Wimbledon, S.W.
†Beaumont, W. B...Bywell Hall, Newc.-on-Tyne
Beaven, Charles...Clyffe Pypard, Wootten Bassett
Becher, Rev. John Drake...Southwell
Beck, Charles W....Upton Priory, Macclesfield
Beck, J....St. Ann Street, Lynn, Norfolk
Beck, Peter...Shrewsbury
Beckett, Richard Trim...Oulton Farm, Tarporley
Beckett, Wm., M.P....Kirkstall Grange, Leeds
Beckitt, Richard...Watton Abbey, Driffield
Beckwith, Rev. H..Eaton Constantine, Wellngtn., Sal.
Beddard, J....Holloway Ho., Prestwood, Stourbridge
Beddoe, Richard C....4, Whetherell Place, Clifton
Beecroft, William...Upton, Chester
Beever, Rev. William Holt...Cowbridge
Beevor, Henry...Blyth, Worksop
Beevor, John, M.D....Newark-on-Trent
Begbie, Alexander...Lytham, Preston, Lancashire
Belcher, Charles...Little Coxwell, Faringdon
†Beldam, Valentine...Royston, Hertfordshire
†Bell, Daniel...Hollins, Whitehaven
Bell, Capt. Henry...Chalfont Lodge, Cheltenham
Bell, Williams R....Gillingham, Bath
Bell, John...Breaks Hall, Appleby, Westmoreland
Bell, Matthew...Bourne Park, Canterbury
Bell, Thos....Brampton Town Foot, Cumberland
Bell, William Read...Gillingham, Bath
†Bence, Capt....Kentwell Hall, Long Melford
Bence, Henry A....Thorington Hall, Saxmundham
Benington, T...Wallingfen Ho., North Cave, Yorks.
Benington, William...Stockton-upon-Tees
†Bennell, Joseph...Hitchin, Herts
†Bennett, B. E...Marston Trussell Hall, Rugby
Bennett, E. ...Bedstone Ho., Aston-on-Clun, Salop
Bennett, George...30, Fenchurch Street, E.C.
Bennett, Rev. Henry Thorpe...Egham
Bennett, James...Ingestone, Ross
Bennett, John...Little Rissington, Burford, Oxon
Bennett, John Ewins...Bosworth Grange, Rugby
Bennett, Jos. B. H....Tutbury, Burton-on-Trent
Bennett, T....Park Farm, Woburn, Bedfordshire

Bennett, Thos. Oatley...Bruton, Somersetshire
Bennett, Wm....Regent Street, Cambridge
Bennion, Ed. David...Summer Hill, Oswestry
Benson, Alan...Papcastle, Cockermouth
†Benson, George...Lutwyche Hall, Wenlock, Salop
Benson, John...Tavistock
Bentall, Edward H....Heybridge, Maldon, Essex
Bentley, Henry...Woodlesford, Leeds
Bentley, Robert John...Firmingley Park, Bawtry
Benyon, Rev. E. R....Culford Hall, Bury St. Edm.
†Benyon, R., M.P....Englefield House, Reading
Beridge, Rev. Basil ..Algarkirk, Spalding
†Berners, John...Holbrook, Ipswich
†Berney, Sir Hanson, Bart....Sheepy, Atherstone
Berry, Kemp...Woodgate, Beckley, Sussex
Besley, Henry...South Street, Exeter
Bessborough, Earl of...Pilltown, Ireland
†Best, Hon. and Rev. S....Abbotts Ann, Andover
Best, Rev. Thomas..Red Rice House, Andover
Bethell, William...Rise, Beverley
Betteley, Joseph...Oakfield, Nantwich
Bettinson, R....Cawthorpe, Bourne, Lincolnshire
Betts, John...King's Langley, Hertfordshire
Bevan, Beckford...(Banker), Bury St. Edmund's
Beverley, Benjamin...Leeds
Beverley, Matthew B....Leeds
Beviss, John...Sydling, Dorchester, Dorset
Biddell, G. Arthur...Ipswich
†Biddell, Manfred...Playford, Ipswich
†Biddell, Herman...Playford, Ipswich
†Biddell, W....Hawstead Hall, Bury St. Edmund's
Biddulph, Robert...Ledbury, Herefordshire
Biddulph, Col. R.M., M.P..Chirk Castle, Chirk, N.W.
Biel, W.... St. Leonard's Farm, Beaulieu, Southpton.
Bigg, E. Smith...The Hyde, Slaugham, Sussex
Bigg, T...Leicester House, Great Dover Street, S.E.
Bigge, Chas. Selby..Bourton Grange, Much Wenlock
Bigge, Matthew Robt....
Biggs, James...Desborough, Kettering
Bill, John...Trent Vale, Stoke-on-Trent
Billington, Leonard...Bull Hotel, Preston, Lancashire
Bingham, Col. R.H...Binghams Melcombe, Dorchester
Birch, William John...R. A. College, Cirencester
Birch, Wyrley...Writham Park, Thetford
†Birchall, T...Kibbleton Hall, Preston, Lancashire
†Bircham, William G....Dunton, Fakenham
Bird, Geo....Chessington Court, Kingston, S.W.
†Bird, J....Yaxley, Stilton, Huntingdonshire
Bird, Josiah...Shouldham Abbey, Downham Market
†Bird, Rev. J. Waller...Briston, East Dereham
†Birkbeck, Henry...Norwich
†Birkbeck, Robert...Gatton, Reigate
Birket, C....Plungington Hall, Preston, Lancashire
Birkin, Richard...Apsley House, Nottingham
Birmingham, Wm....Killerton, Broadclist, Devon
Birt, Jacob...30, Sussex Gardens, Hyde Park, W.
Biscoe, T.P.B....Kingellie House, Newton, Inverness
Bishop, John...3, The Walk, Market Pl., Norwich
Black, Edward...High Street, Boston
Black, James...20, Great George Street, S.W.
Black, John...Marske Farm, Redcar, Yorkshire
Blackbourn, D....Temple Brewer, Sleaford, Linc.
Blackburne, Jas. Taddy...17, Parliament St., S.W.
Blackburne, J. I....Hale, Warrington
Blackburne, Lt.-Col. I., jun....Hale Hall, Warrington
Blackden, J.C....Heatherslaw Ho., Coldstream, N.B.
†Blacker, M. M....Claremount, Claremorris, Mayo
Blackett, Sir E., Bart....Matfen, Newcastle-on-Tyne
Blackstone, J....1, Gloucester Rd., Regent's Pk., N.W.
Blagrave, Col. John...Calcot Park, Reading, Berks
†Blair, John...
Blake, Alfred...Sutton, Stanton-Harcourt, Witney
Blake, Francis John...Norwich
Blake, Jas....Birchmore, Blackwater, Isle of Wight
Blake, Thos...Sycamore Ho., Dynchurch, Folkestone
Blake, William...Bridge, South Petherton
Blake, Wm. John...Danesbury, Welwyn
Bland, George...Coleby Hall, Lincoln
Bland, William...Hartlip, Sittingbourne
Blane, Colonel Robert...2nd Life Guards
†Blanshard, Richard...53, Chancery Lane, W.C.
Blashill, Henry...Steps Farm, Downhill, Hereford
Blencowe, J. George, M.P....Danny, Hurstpierpoint
†Blencowe, Robert A... The Hooke, Lewes
Blencowe, Robert Willis...The Hooke, Lewes
Blenkiron, William...Middle Park, Eltham
†Blisset, Rev. H....Letton, Weobley, Hereford
Blomfield, John...Warham, Wells, Norfolk
Bloomer, G. B...The Farm, Lower Stonnall, Walsall
Bloxsidge, Samuel...Warwick
Blundell, J....Bursleden, Southampton
Blundell, John...Crook Hall, Chorley
Blundell, W. H....Broadwaters Mill, Kidderminster
Blurton, W. Mountfort...Field Hall, Uttoxeter
Blyth, D'Urban...Great Massingham, Rougham
Blyth, H. E....Sussex Farm, Burnham, Lynn
†Blyth, James...24, Hyde Park Gardens, W.
†Board, John...Westerham, Sevenoaks
Boards, Edward...Edmonton, N.
Boards, William...Edmonton, N.
†Boby, Charles...Stutton, Ipswich
Bodenham, Charles...Hereford
†Body, R. B....Hyde End, Shinfield, Reading
Boger, Deeble...Wolsdon, Devonport
†Boghurst, William P....Frating Abbey, Colchester
Bogue, John Morris...Westward Park, Wigton
Boileau, Sir J.P., Bt...Ketteringham Pk. Wymndhm.
Bolden, Samuel E....Springfield Hall, Lancaster
†Bolitho, Edward...Pendlverne, Penzance
†Bolitho, T. S....Pendlverne, Penzance
†Bolitho, William...Penzance
†Bolton, Lord...Bolton Hall, Bedale
Bolton, Daniel...Barley Park, Witney, Oxon
Bond, Barnabas...Alburgh, Harleston, Norfolk
Bond, Benjamin...Draycot, Cheadle, Staffordshire
Bond, Frederick...Whitelackington, Ilminster
Bond, George. . Earl Soham, Wickham Market
Bond, Rev. N....The Grange, Holme, Wareham
Bond, Robert...10, Queen Street, Ipswich
Bone, Henry...Avon, Ringwood, Hants
Bonnell, J. H....Pelling Place, Old Windsor
†Bonner, H. C....East Rudham, Rougham, Norfolk
Bonus, Schröder...Point House, Blackheath, S.E.
†Booth, James Godfrey...Hamburgh
Booth, John B....Killerby, Catterick, Yorkshire
Booth, John...Cotham, Newark, Nottinghamshire

Booth, Richard...Warlaby, Northallerton
Booth, S. Lister...Bramley, Leeds
Booth, W. H....
Booth, Sir Williamson, Bt....Paxton Park, St. Neots
†Borough, C. B....Chetwynd Pk., Newport, Salop
Borthwick, John...Prospect, Carrickfergus
†Bortier, Monsieur...La Panne
Borton, John...Barton-le-Street, Malton
Bosanquet, Rev. R. W....Roch, Alnwick
Bosley, John...Lower Leyde, Hereford
Bostock, Ellis...41, Hunter St., Brunswick Square
Bostock, Thomas...Hill Top, Burslem
†Botfield, Beriah...Norton Hall, Daventry
†Botham, George...Wexham Court, Slough, Bucks
Botly, William...Martin, Salisbury
Bott, William...Nantwich
Botteley, Thos. Downes..Black Lake, W. Bromwich
Botting, William...Westmeston Pl., Hurstpierpoint
Boucherett, Henry Robert...Willingham, Lincoln
†Bouck, John T....13, Oxford Street, Manchester
Boultbee, J....Novadd Ho., Aberayron, South Wales
†Bourn, J., jun....Mawley, Cleobury-Mortimer
Bourne, John...Hildenstone, Stone, Staffordshire
Bourne, William...Atherstone
Bouverie, Hon. P. P., M.P....Brymore, Bridgewater
Bowen, George...Coton Hall, Prees, Market Drayton
Bowen, P. W....Shrawardine Castle, Shrewsbury
†Bower, Edw. Greves..Closworth, Sherborne, Dorset
Bower, Capt. Thomas B...Iwerne House, Blandford
Bowler, Wm. Anthony...9, Whitehall Place, S.W.
Bowly, David...Cirencester
Bowly, Edward...Siddington House, Cirencester
Bowser, R...Bishop Auckland, Durham
†Bowyer, Capt. H. A....Steeple-Aston, Woodstock
Box, John...Civil Engineer
Boxall, W. B....Strathfieldsaye, Winchfield
Boyer, W....Skeffington Vale, Billesden, Leicester
Boys, John...Goldhanger, Maldon
Boys, Robert...Eastbourne
Braby, James...Maybanks, Rudgwick, Horsham
Bracebridge, C. H....Atherstone Hall, Atherstone
Bradburne, J. Hanbury...Pipe Place, Lichfield
Bradbury, Thomas...Longroyd, Brighouse
Bradbury, Thomas Swanwick...Winsford, Cheshire
Bradbury, Wm....Bradley Green Colliery, Congleton
Braddock, Henry...Bury St. Edmund's
Bradford, Thomas...Cathedral Steps, Manchester
Bradley, Thomas...Richmond, Yorkshire
†Bradshaw, John...Knowle, Cranley, Surrey
Bradshaw, W...Slade Ho., Levenshulme, Manchester
Bradstock, Thomas S....Cobrey Park, Ross
Braginton, George...Torrington, Devon
†Braikenridge, J. H....Chew Magna, Bristol
Bramley, Charles...Fiskerton Hall, Lincoln
Bramwell, C....Hardwicke Hall, Ferry Hill, Durham
Brand, Hon. Henry, M.P....Glynde, Lewes
†Brander, R. B....Tanbridge House, Horsham
Branwhite, F...Chapel House, Long Melford, Suffolk
Brasnett, J....Hilboro' Lodge, Brandon, Norfolk
Bravender, John...Cirencester
Bray, George...The Haven, Dilwyn, Leominster
†Braybrooke, Lord...Audley End, Saffron Walden
†Breach, J. G....
Breavington, W. G. K...Bath Road, Hounslow, W.
Brebner, James..Norfolk Farm, Windsor Great Park
Brett, John...Burton Joyce, Nottingham
Brett, John...Oxton Grange, Southwell
Brett, John Lowdham...Corfe Lodge, Wimborne
†Bretts, Chas....
Brewster, Jas....2, Westbourne Road, Barnsbury, N.
Brewster, S. N....Beacon Hill House, Woodbridge
Brewster, Wm....Whiston Hall, Penkridge, Staffs.
Brickwell, C. J....Overthorpe Lodge, Banbury
Bridge, Thomas...Wynford Eagle, Dorchester
Bridge, Thomas...Buttsbury, Ingatestone
Briggs, John A....Eastgate House, Tenterden
†Briggs, Rawdon...Birstwith Hall, Ripley, Yorksh.
Briggs, Rev. T. Barker W...Caple Lodge, Folkestone
†Bright, John...Teddesley Park Farm, Penkridge
Bright, John, M.D....19, Manchester Square
Brinckman, Lady...Sundorne Castle, Shrewsbury
†Brise, Lieut.-Col. S.B.R...Finchingfield, Braintree
†Broadhurst, John...Foston, Derby
Broadmead, Philip...Milverton, Somerset
Bromet, William R....Cocksford, Tadcaster
Bromfield, H...Blockley Vicarage, Moreton-in-Marsh
Bromley, James...Cockerham, Lancaster
Bromley, John...Derby
Bromley, John...Lancaster
Bromley, Robert...Derby
Bromwich, Thomas...Woolston, Coventry
Brook, Arthur Sawyer...Bexhill, Hastings
Brook, J...Park Farm, St. Helen's, Isle of Wight
Brooke, Edward...Marsden House, Stockport
Brooke, John W....Sibton Park, Yoxford, Suffolk
Brooke, John, jun....Capel, Ipswich
Brooke, Rev. John...Haughton, Shiffnal
†Brooke, Sir R., Bart....Norton Priory, Runcorn
Brooke, T. J. Langford...Mere Hall, Knutsford
†Brooke, William...Northgate House, Huddersfield
†Brooke, Sir W. De Capell, Bart....Market-Harbro'
Brookes, Wm., Captain...Elmstree House, Tetbury
†Brooks, Bernard...Lyford, Abingdon
Brooks, James H....Henley-on-Thames
Brooks, J. M....7, Charlotte Street, Manchester
Brooks, Samuel...Bank, Manchester
Broomfield, Thomas...Lauder, N.B.
Broomhall, T. T...Beech Cliff, Newcastle, Staffords.
Broughton, Rev. C....Norbury Rectory, Ashbourne
Broughton, E. D....Wistaston Hall, Nantwich
Broughton, J...Almington Hall, Market Drayton
Brown, David...Cathendine House, Brecon
†Brown, Douglas...15, Hertford Street, Mayfair
Brown, Edward...Estate Office, Northallerton
Brown, George...Avebury, Chippenham
Brown, George...Roborough House, Barnstaple
†Brown, Rev. H. H....
Brown, Henry...Ashby-de-la-Zouch
Brown, James...17, Minto Street, Edinburgh
Brown, John...Tring
Brown, John...Coldham Hall, Wisbeach
Brown, John...Compton, Newbury
Brown, J. Washbourne...Ufcott, Swindon
Brown, Rev. Lancelot R....Kelsall Saxmundham
Brown, Michael L....Cliff Ville, Stoke-on-Trent
†Brown, Potto...Houghton, Huntingdon

†Brown, Thomas...Buckham Hall, Uckfield
†Brown, Thomas...Marham, Norfolk
Brown, Thos. James...The Moor, Hereford
Brown, Thomas Phillpotts...The Wear End, Ross
Brown, William...Tring
Brown, William...Devizes (North Wilts Foundry)
†Brown, William....Richmond Hill, Liverpool
Brown, Wm....Wirswall, Whitchurch, Salop
Brown, W. J....Hazlebury House, Chippenham
†Browne, Lord John Thomas...Wesport, co. Mayo
Browne, Edward...Oaklands, St. Albans
Browne, R. P....Gt. Hallingbury, Bishops Stortford
Browne, Robt. Palmer...Greenwich
Browne, Rev. T. C....59, High Street, Oxford
Browne, Thos. Beale..Salperton Park, Andoversford
Browne,T. B...MellingtonHl.,Churchstoke,Shrewsb.
†Browne, W..Monkton Farleigh Ho. Bradford,Wilts
Browne, William...Titchwell, Lynn
Browning, A. H....Heath Lodge, Iver, Bucks
Browning, F....La Patrimoine, St. Lawrens, Jersey
Browning, James T....Oxford
Brownlow, Earl...Ashridge, Berkhampstead
Bruce, Maj. C. L. C., M.P....Dunphail, Forres, N.B.
Bruce, John...Tiddington, Stratford-on-Avon
Bryan, Frederick Thos....Humberstone, Leicester
Bryan, John...Southleigh, Witney
Brymer, John...1, Belvedere, Weymouth
†Bubb, Anthony....Witcombe Court, Gloucester
†Buck, Albert...Sansome Terrace, Worcester
†Buckingham, Duke of...Wootten, Aylesbury
Buckland, George...Benenden, Cranbrook, Kent
Buckland, J. Avery...Benenden, Cranbrook, Kent
Buckland, Thomas, jun....Wraysbury, Staines
Buckley, Gen. E. P., M.P....New Hall, Salisbury
Buckley, Jas...Penyfai Ho., Llanelly, Caermarthens.
Buckley, John N...Normanton Hill, Loughborough
Buckman, Professor...Dollar Ward, Cirencester
Buckworth, T. R....Cockley Cley Hall, Swaffham
†Budd, J. Palmer...Ystalyfera, Swansea
Budd, William...Aston-le-Walls, Daventry
†Budd, Thos. W....13, Norfolk Crescent, Hyde Pk.
Buddicom, Wm. B ...Penbedw Hall, Mold
Buggins, W....Booth's Farm, New Oscott, Birming.
†Bulford, James...Hordley Farm, Woodstock
†Bulkeley, Sir R.W., M.P...Baron Hill, Beaumaris
Bull, Alban...Hanwell, Banbury
Bulled, Edmund...Witheridge, Devonshire
Bullen, E...Irish Farmers' Cl., Sackville St., Dublin
†Bullen, John T....Marshwood Manor, Crewkerne
Buller, Sir A., Bart.....Pound, Plymouth
Buller, James Wentworth, M.P....Downes, Crediton
†Buller, Morton Edward...Dilhorn, Cheadle
Bullimore, R....Stowgate Farm, Market Deeping
†Bullock, F....Woodlands Hall, Eling, Southampton
†Bullock, George...East Coker, Somerset
Bullock, Walter...Foulkbourn Hall, Witham
Bulmer, Charles...Holmer, Hereford
†Bult, James S....Dodhill Ho., Kingston, Taunton
Bult, Samuel J....Great Abshot, Titchfield
Bulwer, Rev. James...Hanworth Rectory, Thetford
Bulwer, Wm. Lytton...Heydon Hall, Reepham
Bunbury, Henry M....Marlston House, Newbury
Bunny, Capt. Edward John...Slinfold, Horsham
†Bunsen, G....Bourg-Rheindorf, Bonn, Prussia
Burbery, J. J....Crofts, Alveston, Stratford-on-Avon
Burch, Walter J....Campsey Ash, Woodbridge
Burden, R...Castle Eden, Stockton-on-Tees
Burdon, George...Heddon Ho., Newcastle-on-Tyne
Burgess, Capt. H. W....3, Lancaster Ter., Regent's Pk.
Burgess, Robt....Winterbourne, Zelston, Blandford
Burgess, William...95, Newgate Street, City, E.C.
Burgoyne, Sir J. M., Bt...Sutton Park, Potton, Beds
Burkill, E. W....Winteringham, Barton-on-Humber
Burleigh, Robert W....Halesworth
Burn, Robert Scott...Stockport
Burnell, Edward...Roydon, Diss
Burnell, E. P....Winkburne Hall, Southwell, Notts
Burness, Wm...2, South Place, Acre Lane, Brixton
Burnett, Alex....
Burnett, David...Ashley, Stockbridge, Hants
Burnett, Francis...Kingscote, Wotton-under-Edge
Burnett, Gregory...Dee Cottage, Flint
Burnett, Thomas....Hutton, Preston, Lancashire
Burnham, W. B....Spital, Chester
†Burniston, Rich....Greenlands, Henley-on-Thames
†Burr, Daniel Higford...23, Eaton Place, S.W.
Burrard, Sir George, Bt...Walhampton, Lymington
Burrell, Bryan...Broome Park, Alnwick
†Burrell, Charles...Thetford
Burrell, Robert...Palace Green, Durham
Burroughes, H. N...Burlingham Hall, Norwich
Burroughes, Rev. J....Lingwood Lodge, Norwich
Burroughes, Rev. T....Gazeley, Newmarket
Burroughes, William...Colteshall Hall, Norwich
Burrows, Richard...Ruddington, Notts
Burt, Edwin...The Cliff House, Seaton, Axminster
Burt, Henry...6, St. Mark's Square, Regent's Park
Burton, Mrs....Longnor Hall, Shrewsbury
Burtt, J. B....Kettering
Bury, Charles...Nazing, Essex
Busby, Henry Goodear...Moreton-in-the-Marsh
†Bush, John W....Fairwood, Westbury
Bush, R. Hilhouse...Litfield Ho., Clifton, Bristol
†Bushby, Henry Jeffreys...40, Chester Square, S.W.
Bushell, William...Poulton, Wingham, Kent
Busk, E. Thos...Ford's Grove, Edmonton, Middlesex
†Busk, Joseph...Codicote Lodge, Welwyn
Butcher, W....Bowling Green Farm, Ewell
†Butler, The Hon. C. L...Coton House, Rugby
Butler, Capt. G...Stanford Place, Faringdon, Berks
Butler, Capt. J....Kirby Ho., Inkpen, Hungerford
Butler, Lieut.-Col....Liphook
†Butler, Wm....Badminton, Chippenham
Butt, Henry...Kemerton, Tewkesbury
Butt, Henry...Southgate Street, Gloucester
Butt, T....Pirton Farm, Kempsey, Worcestershire
Buxton, W....Lime Tree Lodge, Rotherhithe, S.E.
Byrd, David...Milford, Stafford
Byrd, Sampson...The Leese Farm, Stafford
Byers, Stephen...Chambers Farm, Epping
Bywater, R. F....Coniston, Ambleside

C.

Cabrera, Gen. (Ct. de Morella)...Wentworth, Chertsey
Cadle, Clement...Ballingham Hall, Ross

Cadle, John...Much Birch, Ross
Cadogan, Mrs....Brenkburn Priory, Morpeth
Caffin, Peter...Worth, Surrey
Caines, James...Cheselborne, Dorchester, Dorset
Caird, Jas., M.P....Baldoon, Newton Stewart, N.B.
Calcott, Charles...Belton, Shrewsbury
†Calcraft, J. H., M.P....Kempstone, Corfe Castle
†Caldecott, Thos..Rugby Lodge, Rugby, Warwicks.
Caldecott, C. M....Holbrook Grange, Rugby
Caldwell, H. B...Lackham House, Chippenham
Caldwell, Capt. F. E....Langford Lodge, Brandon
†Caless, Wm....Bodicote House, Banbury
†Call, Sir W. B., Bart....Whitford Ho., Callington
Calthorpe, Hon. F. H. W. G., M.P...PerryHall, Staffs.
Calverley, John...Oulton Hall, Leeds
†Calverley, Chas. C....Teaninich Ho., Alness, N.B.
†Calvert, Frederic...9, St. James's Place, S.W.
†Calvertt, J. S...Tothill Manor House, Alford, Linc.
Cambridge, W. C....Sydney Villa, Bedminster
Camden, Marquess...Wilderness Park, Seven Oaks
Cammell, Chas....Wadesley House, Sheffield
†Cameron, A. H. F....Lakefield, Glen Urquhart
Camp, James...Ilfracombe
Campo, J. W. del...3, Knightsbridge, S.W.
Campbell, A....Auchindadroche, Lochgilphead
Campbell, R....Buscot Park, Lechlade
Campbell, Sir A. T. C., Bart....Wyseby, Dumfries
Campion, Wm. J....Darruys, Hurstpierpoint
Camps, Henry...Salterley Grange, Cheltenham
Camps, Wm....40, Park St., Grosvenor Square
Cane, Edward...Berwick, Lewes
Cane, Rev. T. C.....Southwell, Nottinghamshire
Cann, W. M....Dawlish, Devon
Canning, George H...Shottery, Stratford-on-Avon
Canning, Wm. Browne...Chisledon, Swindon
Cannon, Joseph Sims...Beckley, Oxford
Cantrell, Charles Seward...Riding Court, Windsor
Cantrell, H....Bayliss Court, Slough, Bucks
†Capel, Arthur...Bulland Lodge, Wiveliscombe
Capel, Wm....The Grove, Stroud, Gloucestershire
Capper, R. Harcourt...N. Gate, St. Weonard's, Ross
Capron, George...Stoke, Northamptonshire
†Carew, Thomas...Collipriest House, Tiverton
†Carew, W. H. Pole...Antony House, Devonport
Cardus, T....Barwell Court, Kingston, Surrey
Cardwell, E. H....11, Cromwell Place, W.
Carey, Arthur....Oak Hall, Wanstead
Cargey, George...Sandon Hall Farm, Stafford
†Carleton, Hon. and Rev. R....24, Grosvenor Place
†Carline, R....Lincoln
Carlin, Wm., jun....Marsh Cott., Keyingham, Hull
†Carnegie, David...Eastbury, Watford
Carnegie, Hon. J. J....Fair Oak, Petersfield
Carr, William...Stackhouse, Settle
Carrington, G., jun....The Abbey, Great Missenden
Carroll, W. Hutchinson...Tulla House, Nenagh
Carter, G....Tyndales, Danbury, Chelmsford
†Carter, John Bonham, M.P....Adhurst St. Mary's
Carter, J. R....Lanark Villa, Torquay
Carter, M. F....Newnham, Gloucester
Carter, Richard H....Hullavington, Chippenham
Carter, R. M....Leeds
Carter, William...Boughton Blean, Faversham
†Cartwright, Col. H., M.P....Kineton, Warwick
Cartwright, John...Craycombe House, Pershore
Cartwright, John...Shrewsbury
Cartwright, Nathaniel...Haugham, Louth
Cartwright, Richard Aubrey...Edgcott, Banbury
Cartwright, T. R. B...Aynhoe, Brackley, Northamp
†Cartwright, T. W...Ragnall Hall, Newton, Newark
Cartwright, Col. W....Weedon, Northamptonshire
Cartwright, W. S...Stow Ho., Newport, Monmouths.
Carver, William...Ingarsby, Leicester
†Case, J. B...Poulton Hey, Bebbington, Birkenhead
Case, Thomas H....Testerton Hall, Fakenham
Castellain, Alfred...Liverpool
Castree, Josiah...College Green, Gloucester
Catchpool, Edward...Feering Bury, Kelvedon
Cater, J. W....West Lodge, Barnet
†Cathcart, Earl...Thirsk
Cathcart, Sir John A., Bart....Cooper's Hill, Staines
†Cathcart, R...Pitcairlie Ho., Auchtermuchty, Fifes.
Cator, Major-General (R.H.A.)...Arsenal, Woolwich
†Cator, Rev. T....Wentbridge House, Pontefract
†Caulfield, J. Molyneux, Lt.-Cl...Moy, co. Tyrone
†Caulfield, St. George...Donamor Cas., Roscommon
Caulton, John T....Lighthorn, Warwick
Causton, Joseph...Champion Hill, Camberwell, S.
Cave, Henry Haddon...Desborough, Kettering
Cavendish, Lt.-Col. W. H. F...Ayot St. L., Welwyn
†Cavendish, Hon. Capt. G., R.N....Chertsey
Cavendish, Lord G. H., M.P....3, Upper Eccleston St.
†Cavendish, Hon. Wm., M.P...Latimer, Chesham
Cawdor, Earl of...Stackpole Court, Pembroke
Cawley, Thomas...Nantwich
Cawton, Wm....Somersall Hall, Chesterfield
Cayley, Sir Digby, Bart....Brompton, York
Cazalet, Rev. W. W....Pinner
Chadwick, Edward...
Chadwick, E., C.B....5, MontagueVil. Richmond, Sur.
†Chadwick, Elias...Pudleston Court, Leominster
†Chadwick, F....The Hermitage, Grimsargh, Preston
Chadwick, T....Wilmslow Grange, Cheshire
Chadwick, William...Burlish Lodge, Stourport
†Chafy, Westwood W....Bowes House, Ongar
Chalcraft, William...Bramshot House, Liphook
Chalcraft, Thomas...Amory Farm, Alton
Challenor, John...Blackwood, Leek
Chamberlain, Henry, jun...Bredicot Court, Worcester
†Chamberlayne, Thos....Cranbury Pk., Winchester
Chambers, George...High Green House, Sheffield
Chambers, John...The Hurst, Tibshall, Alfreton
Chambers, Thomas, jun....Colkirk, Fakenham
†Chambers, Wm....Hafod, Rhayader
Champion, Wm. W....Calcot, Reading
Champneys, Rev. T. P....Badsworth, Pontefract
Chandler, Henry...Salford, Manchester
Chandler, Thomas...Aldbourne, Hungerford
Chandler, W. B....Hacheston, Woodbridge
Chaplin, Frederick...Taithwell, Louth
Chapman, J. W....Moggaddy Farm, Maynooth
Chapman, R. H....Upton, Nuneaton
Chapman, Thos....23, New Street, Spring Gardens
Chapman, William...Cornhill, Ipswich
†Charlesworth, J....Headfield, Dewsbury, Yorkshire
†Charlton, St. John...R. A. College, Cirencester

†Charlton, St. J. C...Apley Cts., Wellington, Salop
Charlton, W. H....Hesleyside, Hexham
Chasemore, Philip...Horsham
Chater, J. S....Chippenham, Slough
Chawner, Henry...Hound Hill, Uttoxeter
Chawner, Richard...Hare Hill, Doveridge, Derby
†Chawner, Richard Croft...The Abnalls, Lichfield
Cheale, Alexander, jun....Uckfield, Sussex
Cheere, Rev. G....Papworth Hall, Caxton, Cambr.
Cheere, W. H....Papworth Hall, Caxton, Cambridge
Cheflins, Henry...Little Easton Manor, Dunmow
Cheney, Edward....Gadsley Hall, Melton Mowbray
Cheney, R. H....Badger Hall, Shiffnal, Shropshire
Chetwode, Sir J. N. L., Bart....Market Drayton
Chetwynd, Sir G....Grendon Hall, Atherstone
Chetwynde, Major W. F....Brocton Hall, Stafford
Chichester, Bishop of...The Palace, Chichester
Chick, John...Compton Vallence, Dorset
Chick, Thomas...Stratton, Dorchester, Dorset
Child, Coles...The Palace, Bromley, Kent
Child, Thomas...Slinfold, Horsham
Chinery, John...Wootton Milton, Lymington
Chitty, Edward...Guildford, Surrey
Chivas, George...Chester
†Cholmondeley, Lord H....Holly Hill, Southampton
Chrisp, Thomas..Hawkhill, Alnwick
Christy, James, jun....Boynton Hall, Chelmsford
Chune, George...Coalbrookdale, Salop
Church, John...Woodside, Hatfield
†Churchill, George...Aldershot, Fordingbridge
†Churchill, Lord...Wychwood Park, Oxon
Churchill, H....Barton Ho., Morchard Bishop, Devon
†Churston, Lord...Lupton, Torquay
†Churton, John...Foregate Street, Chester
Chute, W. L. Wiggett...The Vine, Basingstoke
Clare, Charles L....Higher Broughton, Manchester
Clare, W. Harcourt...Twycross, Atherstone
†Clarance, John...114, Leadenhall Street, E.C.
Claridge, William P....Pitchford Park, Salop
†Clarina, Lord...Elm Park, Limerick, Ireland
†Clark, H...Ellinthorpe Hall, Boroughbridge, Yorks.
Clark, Rev. John Crosby...Chertsey
Clark, John Wm....Lockerley, Romsey, Hants
Clark, Thomas...Derndale, Hereford
Clark, William J....Rose Hill, Caversham, Oxon
Clarke, Edward...Glentworth, Lincoln
Clarke, Edw....Glebeland House, Lee, Kent
†Clarke, James...Carlisle
Clarke, G. R....Chesterton Lodge, Bicester
Clarke, Henry...Binbrooke, Market Rasen
Clarke, John...Long Sutton
Clarke, Nathaniel...Beamish Park, Fence Houses
Clarke, Robt. B....Haynes Hill, Barbadoes
†Clarke, T. E....Tremlett House, Wellington, Som.
Clarke, Thomas T....Swakeleys, Uxbridge
Clarke, Wm. B....Bickermont, Whitehaven
Clarkson, Rev. T. L....South Elmham, Norfolk
†Clavering, Sir Wm....University Club, Suffolk St.
Clay, Charles...Walton Grange, Wakefield
†Clay, Sir W., Bart....Fulwell Lodge, Twickenham
Clayden, John...Littlebury, Saffron Walden
†Clayden, John C....Littlebury, Saffron Walden
Clayden, Samuel...Linton, Cambridgeshire
Clayton, David S....Norbury, Stockport
Clayton, H....21, Upper Park Place, Dorset Square
Clayton, John...Newcastle-on-Tyne
Clayton, John...Hook, Kingston, S.W.
†Clayton, Nathaniel...Melville Street, Lincoln
Clayton, R.C.B..Carigbyrne, Adamstouse, Enniscorthy
Clayton, J. G....Wetherby Grange, Wetherby
Cleasby, Thomas M....Wilton Grange, Redcar
Cleave, Benjamin...Newcombe, Crediton
Clements, C. F....Hesmond's Lodge, East Hothly
†Clerk, E. H....Burford, Shepton Mallet, Somersets.
Cleveland, Duke of...Newton House, Bedale
Cliffe, Thomas...Crew Gates, Crewe
Clifford, Henry Clifford...Frampton Court, Dursley
Clifford, Col. H. M....Llantilio, Cosseney, Ragland
Clifford, William...52, Parliament Street, S.W.
†Clinch, Charles...Eagle Brewery, Witney
Clinton, Col. Fred....Ashley Clinton, Lymington
Clinton, Lord...Hinton House, Crediton, Devon
†Clonbrock, Lord...Clonbrock, Ahaserah, Ireland
Clough, John...Bootham, York
†Clowes, Edmund...Carnforth, Lancaster
Clowes, George...89, Westbourne Terrace, W.
Clowes, Wm...51, Gloucester Ter., Hyde Pk. Gard.
Clowes, Col. W. L. ...Broughton Old Hall, Manch.
Clutterbuck, Rev. J.C...Long Wittenham, Abingdon
Clutterbuck, R....Watford Ho., Watford, Herts
Clutton, John... 9, Whitehall Place, S.W.
Clutton, Robert...Hartswood, Reigate, Surrey
Clutton, Robt. G....9, Whitehall Place, S.W.
Clutton, Thos. C....Chorlton Hall, Malpas, Cheshire
Clutton, Wm....Portland Villa, S. Norwood
Clutton, Wm. James...The Mount, York
Coatsworth, John, Great Grimsby
Cobb, Geo. Henry...Greenwich
†Cobb, Henry...10, Lincoln's Inn Fields
Cobb, Robert L....Higham, Rochester
Cobb, Timothy Rhodes...Banbury, Oxon
Cobb, William Henry...Colchester
Cobbett, John M....Skeynes, Edenbridge
Cobbold, John Chevallier, M.P....Ipswich
Cobden, Richard, M.P....Midhurst
Cobon, James...Well Hall, Lynn, Norfolk
Cochrane, James...Harburn, Edinburgh
†Cocks, Rev. C. R. Somers...Cleobury Mortimer
Cocksedge, James...Stowmarket
Codd, Henry...Ashwarren, Overton
Cohen, Wm....Chestnuts, Figgs Marsh, Mitcham
†Coke, Hon. E. K....Longford Hall, Derby
Coldham, H. W....Anmer, Lynn, Norfolk
†Cole, R. J...11, Pembridge Gardens, Bayswater, W.
Cole, Thomas H...The Green, Wick, Bath
Cole, Wentworth L...Cirencester
Coleman, John...R. A. College, Cirencester
Coleman, John...Park Farm, Woburn, Beds
Coleman, Richard....Langdon Abbey, Dover
Coleman, Richard....Chelmsford
Coleman, Walter, Kingsbury Hall, Tamworth
†Coles, Alfred...Clifton Lodge, Clapham Park, S.
†Coles, H. B....Middleton Ho., Whitchurch, Hants
Collin, Rev. J., jun....Rickling Vicarage, Herts
Collings, Rev. William T....Guernsey
Collingwood, E...Dissington Hall, Newc.-on-Tyne

†Collins, Henry...38, Lincoln's Inn Fields, W.C.
†Collins, John...Wonham, Bampton, Devon
Collins, Wm....Aston Farm, Stafford
Collyer, Rev. Canon R...Warham Rect., Wells, Norf.
Colquhoun, J. C....Chartwell, Westerham
†Colyer, William...North End, Crayford, Kent
Colthurst, John...Chew Magna, Bristol
Colthurst, J. C....Huntworth Pk. Farm, Bridgwater
Colvile, Rev. A. A...Livermere Rectory, Bury St. Ed.
Colvile, Major-Gen...Kempsey House, Worcester
Colvile, C. R., M.P...Lullington Hl., Burton-on-Tr.
†Colvin, B. B....Waltham Abbey, Essex
Combe, R. H....Pierrepoint, Frensham, Farnham
Combermere, Visc...Combermere Abbey, Nantwich
†Compton, H. C., M.P....Lyndhurst, Hants
†Compton, R....Eddington House, Hungerford
†Condie, James...Perth
†Congreve, S. B....Harbors Magna, Rugby
†Congreve, T....Leamington Hastings, Rugby
†Congreve, W....Comb Fields, Brinklow, Coventry
Conington, Clement...Hagworthingham, Spilsby
Constable, Sir Clifford, Bt...Burton Constable, Hull
Constable, Rev. J....R. A. College, Cirencester
Conway, Wm. S....Bodryddan, St. Asaph's, Flintsh.
Cooch, Joshua...Harleston, Northampton
Cook, George...Flitwick, Ampthill
Cook, George...22, Aberdeen Park, Highbury, N.
†Cook, John...Hothorpe, Welford, Northamptonsh..
Cooke, B. G. D....Colomendy, Mold
Cooke, Grimwood....Linton, Cambridgeshire
†Cooke, Henry...High Street, Hereford
Cooke, James H....Berkeley Castle, Gloucestershire
Cooke, Rev. James Y....Semer, Ipswich
Cooke, Robert C....Livermere, Bury St. Edmund's
Cooke, William, C.E....26, Spring Gardens, S.W.
†Cooke, Wm. Fothergill...Eliot Ho., Blackheath
Cookson, John...Meldon Park, Morpeth
Coombs, T....South Street, Dorchester, Dorset
†Cooper, C. B....Micheldever, Hants
Cooper, Edward...Henley-in-Arden
Cooper, G. Kersey...Euston, Thetford
Cooper, Henry Reeve...Shirburne Castle, Tetsworth
Cooper, Isaac...Long Brackland, Bury St. Edmund's
Cooper, John...Swineshead House, Spalding
Cooper, Jonathan...Barton, Bury St. Edmund's
†Cooper, N. J....Westgate, Mansfield
Cooper, W. W....Barnham, Thetford
Cooper, Rous John...Blythburgh Lodge, Halesworth
†Coote, E. (11th Hussars)..West Pk., Fordingbridge
Copeman, George...Dunham Lodge, Swaffham
Copeman, Robert, jun....Hemsley, Great Yarmouth
Copestake, Thos. G....Kirk Langley, Derby
†Coppard, T....Lanehurst Lodge, Hurstpierpoint
Corbet, H....Farmers' Club, Bridge St., Blackfriars
†Corbet, H. R....Adderley Hall, Market Drayton
†Corderoy, Edward...Clapham Park, S.
Corfield, Wm....Butteley Hayes, Audlem
Corner, Edward...Esk Hall, Whitby
Corner, J. B....Longforth, Wellington, Somerset
Corner, Richard...Torweston, Williton, Taunton
Cornes, James...Barbridge, Nantwich
Cornewall, Sir V., Bart....Moccas Court, Hereford
Corrance, F....Parham Hall, Wickham Market
Corringham, R. W....Lound House, Haxey, Bawtry
Coryton, Augustus...Pentillio Castle, Cornwall
Cosens, William...Langdon Dawlish, Devon
Cotes, Rev. C. G...Stanton St. Quintin, Chippenham
Cother, William...Middle Aston, Woodstock
†Cotta, Baron G....Hipfelhof, Heilbronn, Germany
Cottam, George H....Old St. Pancras Road, N.W.
†Cotterell, Jacob Henry...6, Terrace Walks, Bath
Cottingham, John G....Chesterfield, Derbyshire
†Cotton, Alexander...
Cotton, H....Amor Hall, Washbrook, Ipswich
Cotton, H. P....Quex Park, Isle of Thanet
Cotton, Maj.-Gen. T. Conyers...Cilhendre, Ruabon
†Cotton, Lt.-Col. Hon. W. H. S....Malpas, Cheshire
†Couchman, C....Temple, Balsall, Birmingham
Couchman, J. W....Tottenham Green, Middlesex
Coulson, Col...Blenkinsopp, Haltwhistle, Northum.
†Coulthard, G....Stone House, Haybon, Carlisle
Coulton, William...Dean Court, Ashburton
Coupland, John G....Freeston, Boston
Coupland, J....Southampton
†Court, P. Simpson...140, Snargate Street, Dover
Courthope, G. C....Whiligh, Hurst Green
Coussmaker, Lannoy...Westwood, Farnham, Surrey
Coverdale, John...4, Bedford Row, W.C.
†Cox, Henry...Trevereux, Edenbridge, Kent
Cox, Joseph...Wisbeach
Cox, Samuel Walker...Spondon Cottage, Derby
Cox, William...Brailsford, Derby
Cox, Wm. Thos....Spondon Hall, Derby
†Coxe, James...Newtown Lodge, Hungerford
Coxon, John...Treeford Farm, Lichfield
Coyney, C....Weston Coyney, Longton, Staffordsh.
Cradock, Thomas...Quorndon, Loughborough
Crane, Edward...Forton, Montford, Shrewsbury
Crane, James...Tolpuddle, Dorchester
Crane, James...Shrawardine, Salop
†Cranston, Thomas...Little Dilwyn, Leominster
Crawford, Rev. W. H....Haughley Park, Woolpit
Crawford, Wm. H....Lakelands, Cork
†Crawley, John S....Stockwood Park, Luton
Creese, William...Teddington, Tewkesbury
Cressingham, Jonah...Carshalton, S.
Cresswell, Gerard O....Sedgeford Hall, King's Lynn
Cresswell, R. W....Ravenstone, Ashby-de-la-Zouch
Cresswell, Robert...Idridgehay, Wirksworth
Cresswell, A. J. Baker...Cresswell, Morpeth
Crewe, Sir J. H., Bart....Calke Abbey, Derby
†Crisp, Thomas...Butley Abbey, Wickham Market
Crisp, Arthur William..Gedgrave Hall, Woodbridge
†Croft, Arthur H....Hutton, Buscell, York
Croft, Rev. Archdeacon J....Saltwood, Hythe, Kent
†Croft, Sir John, Bart....Kingsdown, Sittingbourne
†Crofton, Lord...Mote Park, Athlone, Ireland
†Crofts, Rev. C. D....Caythorpe Rectory, Grantham
Crofts, John...Long Lawford Hill, Rugby
Crofts, T. W....Lawford Hill, Rugby
Crompton, G....
Crompton, George...Chesterfield
Croome, James...Breadstone, Berkeley, Gloucesters.
Croote, G. H...Crooke, North Tawton, Devon
Crosbie, Wm. T....Ardfert Abbey, Tralee, Ireland
†Cross, Wm. A....Red Scarr, Preston, Lancashire

Crosse, Thomas B....Shaw Hill, Chorley
Crosskey, John...Lewes
Crosskill, William, Trustees of...Beverley
Crosskill, Alfred...The Iron Works, Beverley
Crosthwaite, John...
†Crow, G....Ornhams, Boroughbridge, Yorkshire
Crowley, John L....Standford Hall, Newport, Salop
Croxon, John...Llanoorda Isaf, Oswestry
†Crump, G. W...Woollas Hill, Eckington, Pershore
Crump, Thomas...Whitefield, Tewkesbury
Crundwell, George...Wilton Place, Maidstone
Cruso, John...Leek, Staffordshire
Crutchley, P. H....Sunninghill Park, Staines
Cubitt, Wm. (Lord Mayor)...Andover
Cuff, J. H....New Cattle Market, Islington, N.
†Cuff, W. Fitchett...Merriott, Ilminster
Culley, John...Easton, Pewsey, Wilts
Culverwell, Jas....Wedmore, Weston-super-Mare
Cumberbatch, L....Queen's House, Lyndhurst
†Cumming, L....Ratten, Thurso, N.B.
Cuninghame, John...Hensol, Castle Douglas, N.B.
†Cure, Capel...Blake Hall, Ongar, Essex
Cureton, George...Bean House, Shrewsbury
Currie, Edmund...Adbury House, Newbury
Currie, Henry...West Horsley Park, Leatherhead
Currie, Raikes...Minley Manor, Farnboro', Hants
Currie, Wm. Pitt...Gt. Vaynor, Narberth, Pembroke
Curtis, Capt. C....Pailton House, Lutterworth
Curtis, Charles E....Alton
Curtis, E....Dummer Grange, Basingstoke
†Curtis, Sir Wm., Bart....Caynham Court, Ludlow
Curtler, T. G....Bevere House, Worcester
Curzon, Hon. S. C. H. R....Grove Ho., Tooting, S.
Cust, Capt. F. Henry...Ellesmere
Cust, Leopold...Tipperary
Custance, Hambleton F....Weston House, Norwich
Cuthbert, Robert...Newton-le-Willows, Bedale
†Cuthbert, William...Beaufront, Hexham

D.

Dacre, Lord...The Hoo, Welwyn, Herts
†Dacre, Joseph...Kirklinton Hall, Carlisle
Dalgairns, William...Rosaire, Guernsey
Dalton, James...Fillingham Manor, Lincoln
Dalton, Thomas...Cardiff
Danger, Thomas...Huntstile, Bridgewater
Daniel, John W....Coton Park, Burton-on-Trent
Daniel, Thomas...Stoodley, Tiverton
†Daniel, Thos. D....Stuckeridge, Bampton, Devon
†Darbishire, S. D....Pendyffryn, Conway
Darby, George...Marklye, Warbleton, Hurst Green
†Darby, Abraham...Stoke Court, Slough
†Dare, F. M. Hall...
Dare, R. W. Hall...Newtownbarry, Ireland
Darley, Chas. Albert...Burtonfield, York
Darling, Charles...The Hall, Langham, Colchester
†Darling, J....Beau Desert, Rugeley
Darling, Robt....Plawsworth, Fence Houses
Darnbrough, Thos. S....27, Coney Street, York
Darvill, Henry...Windsor
Dashwood, Francis...Halcot, Bexley, Kent
†Dashwood, F. Loftus...Kirtlington Park, Oxon
Dashwood, Sir Henry W., Bt....Kirtlington, Oxford
†Dashwood, M....9, Seamore Place, Mayfair, W.
Daubeny, Edmund J...Cleve House, Yatton, Somers.
Daubeny, Rev. E. A....Ampney, Cirencester
Daubeny, R....King's Bench Walk, Temple, E.C.
Davey, George...Buckland, Faringdon, Berks
Davey, Richard, M.P....Redruth, Cornwall
David, Edward...St. John's Place, Hereford
David, Evan...Fairwater, Cardiff
Davie, Sir H. Ferguson, Bart....Creedy, Crediton
Davies, D. Price...Troedybryn, Llandilo
Davies, D. R....Mere Old Hall, Knutsford
†Davies, E. H....Hampton Bishop, Hereford
Davies, Rev. J....Moor Court, Herefordshire
Davies, Rev. R. T....Crickhowell, Brecknockshire
Davies, Richard...Aylestone Hill, Hereford
Davies, Robert C....Southminster, Maldon
†Davies, Robt. P....Ridgeway, Narberth, S. Wales
Davies, Rev. S...The Grange, Oystermouth, Swansea
Davies, Mrs. Susanna...Rochlaveston Manor, Notts
Davies, Thomas...Burlton Court, Burghill, Hereford
Davies, Rev. W. I. K....Croft Castle, Leominster
Davis, Henry...Old Downs, Oakhill, Bath
†Davis, John...Cranbrooke, Ilford, E.
Davis, Peter...Bickmarsh Hall, Alcester
†Davis, R....9, St. Helen's Place, Bishopsgate, E.C.
†Davis, R. F....1, Westbourne Grove Terrace, W.
†Davis, R. S. B....Swerford Park, Enstone, Oxon
†Davis, Samuel...Swerford Park, Enstone, Oxon
Davis, James...Melcombe Horsey, Blandford
Davis, T....Little Wenlock, Wellington, Shropshire
Davison, Thomas...Durham
Davey, Jas....Flitton-Barton, South Molton
Davey, J. S....Redruth, Cornwall
Davy, John T....Barton Roseash, South Molton
Davy, Robert...Ringwood, Hampshire
Dawes, John S....Smethwick House, Birmingham
Dawkins, E. H. F....Moggerhanger Ho., St. Neot's
Dawson, Edward...Aldcliffe Hall, Lancaster
Dawson, J....Gronant, Rhyl, Flintshire, N.W.
Dawson, J....Blair Hill Mains, Culross, N.B.
†Dawson, Wm. Edward..Plumstead Common, Kent
Day, Charles...Colleyweston, Stamford
Day, Francis...Priory, St. Neot's, Hunts
Day, John...Newick Lodge, Uckfield, Sussex
Day, Samuel...St. Neot's
†Day, William...Woodyates, Salisbury
†Deacon, John...Mabledon, Tonbridge
†Dean, A. K....East Brent, Axbridge, Somerset
†Dean, F. K....East Brent, Axbridge, Somerset
Deane, F. H....Eastcot, Ruislip, Watford
Deane, Rev. Henry...Gillingham, Dorset
Deane, William Anthony...Webbery Ho., Bideford
Dearden, James...Poole
Death, Ambrose...Lawshall, Suffolk
†De Curzay, Visct...Château de Curzay, Lusignan
Deedes, Major G....Hillhurst Farm, Hythe
Deedes, William, M.P....Sandling Park, Hythe
De L'Isle Dudley, Lord...Penshurst Park, Kent
Delves, William...Frant, Tonbridge Wells
De Mauley, Lord...Down Ampney, Cirencester
†Demidoff, Prince...Florence

†Denbigh, Earl of...Newnham Paddock, Lutterworth
Denchfield, J....Aston Abbotts, Aylesbury
Denison, Edmund...Doncaster
†Denison, Sir W., Bart....New South Wales
Denison, W. Beckett...Burley, Leeds
Denman, Lord...Middleton Hall, Bakewell
Denne, Wm....Three Counties Asylum, Baldock
†Dennett, Mullens...Lodsworth, Petworth, Sussex
Dennis, John Chas....Rosebrough, Northumberland
Dennis, Robert...Greetham, Horncastle
Denson, Samuel...Picton Hall, Cheshire
Dent, Joseph...Ribstone Hall, Wetherby
Dent, Joseph...Neasham Hall Farm, Darlington
Dent, John D., M.P....Ribstone Hall, Wetherby
Dent, Ralph...Streatlam Castle, Barnard Castle
Dester, Wm....Seckington, Tamworth
De Rothschild, Sir A., Bt....Aston Clinton, Tring
De Salis, Rev. H. D....Fringford Rectory, Bicester
†De Trafford, Sir H., Bt...Trafford Pk., Manchester
Devas, Charles F....Bromley Lodge, Kent
Devas, William...Woodside, Old Windsor
Deverell, John...Purbrook Park, Portsmouth
Devincenzi, Signor Giuseppe...44, Thurloe Sq., W.
Des Vœux, Sir Henry ...Drakelow Pk., Burton-on-Tr.
†De Vitre, H. D....Charlton House, Wantage
†Devon, Earl of...Powderham Castle, Exeter
Devon, Chas...St. Vincent's, Haddington, Maidstone
Dew, Tomkyns...Whitney Court, Hereford
Dewar, William...Middleton, Bicester
Dewe, Wm. T....Manor House, Coates, Cirencester
†De Wezele, Count G....
Dewhurst, George...Brown Street, Manchester
†Dewing, R ...Carbrooke, Watton, Norfolk
De Winton, J. P....
De Winton, Capt. T....Wallsworth Hall, Gloucester
†Dickens, Charles Scrace...Horsham
Dickin, John...The Lodge, Chirk
Dickinson, W. F. D....Ulverston, Lancashire
Dickins, R. A...Woodford Grange, Wolverhampton
Dickinson, H....Severn Ho., Colebrookdale, Salop
†Dickinson, E. H....King's Weston, Somerton
Dickinson, John...Abbott's Hill, Watford, Herts
Dickinson, William...New Park, Lymington
†Dickons, Thomas...High Oakham, Mansfield
Dickson, James...Chester
Digby, G. D. Wingfield...Sherborne Castle, Dorset
Digby, Lord...Minterne House, Dorchester, Dorset
Digby, Rev. K...Tetteshall Rectory, Litcham, Norf.
Digby, Lt.-Col. R...6, Chapel St., Grosvenor Sq., W.
†Dilke, Sir C. Wentworth, Bt....76, Sloane St., S.W.
Dilke, C. W....76, Sloane Street, S.W.
†Dilke, Charles W....76, Sloane Street, S.W.
†Dillon, Viscount...Dytchley Hall, Enstone, Oxon
†Dinning, J...Adderstone, Belford, Northumberland
Disney, Edgar...The Hyde, Ingatestone
Disraeli, Rt. Hn. B., M.P...Hughenden Man., Bucks
†Divett, Edward, M.P....Bystock, Exmouth, Devon
Divett, John...Bovey Tracey, Devon
Dix, George Weatherstone...Howden, Yorkshire
Dixon, Henry...Frankham, Tunbridge Wells
Dixon, Henry Hall...10, Kensington Square, W.
Dixon, Hugh...5, India Buildings, Liverpool
Dixon, Isaiah...Grove Terrace, Leeds
Dixon, John...Harmston, Lincoln
Dixon, J. T....Dunterley, Bellingham, Northumb.
†Dixon, John W....Beasby, North Thoresby, Louth
Dixon, Peter...Holme Eden, Carlisle
Dixon, Thos. John...Holton, Lidgate, Newmarket
†Dixon, Thos. Parkinson...Caistor, Lincolnshire
Dixon, Wm. F....Page Hall, Sheffield
Dobits, George...Caistor, Lincolnshire
Docker, Ludford...Paul's Hill, Leigh, Tunbridge
†Dod, Whitehall...Llannerch, St. Asaph
Dod, J. W., M.P...Cloverley Hall, Whitchurch, Salop
†Dodson, Charles E....Littledale Hall, Lancaster
Dods, T. P....Anick Grange, Hexham
Dodwell, J....Manor House, Long Crendon, Oxon
Doggett, Thomas William...Sandon, Royston
Dolphin, T....Swafield, North Walsham, Norfolk
Donald, W....St. James's Hall, Regent Street, W.
†Donovan, George (49th Regt.)...
Donovan, J. C....Gatwick, Mill Hill, Billericay
Dorrell, Thomas...Bishampton, Pershore
Dorrington, C....Bridehall Farm, St. Albans
Dormer, C. Cottrill...Rousham, Woodstock, Oxon
†Dorrien, C....Ashdean, Funtington, Chichester
Doubleday, E....Long Clawton, Melton Mowbray
Douglas, James...Athelstaneford, Drem, N.B.
Dowden, Thomas...Roke Farm, Bere Regis
Dowding, Edwyn...15, Vineyards, Bath
Downing, J. B....Holme Lacey, Hereford
Downs, Henry...Manor House, Basingstoke
Downs, J. H....Grove Lodge, Fulham
Dowson, B....Quay, Yarmouth
Downward, Rev. George R....Shrewsbury
Downward, John...Hampton Hall, Malpas
Drake, Sir T. T. F. E., Bart...Nutwell Court, Exeter
†Drake, T. Tyrwhitt...Shardloes, Amersham
Drakeford, David...Dillions, Crawley, Sussex
Draper, J. S....Thingehill, Hereford
†Drax, J. S. W. Erle, M.P...Charborough Pk. Blandford
Dray, William...Farningham, Kent
Drew, Henry...Peamore, Exeter
†Drewe, E. Simcoe..The Grange, Honiton
†Drewitt, George...Manor Farm, Oving, Chicheste
Drewitt, Henry...Milvill Farm, Titchfield
Drewitt, John...North Stoke, Arundel
†Drewitt, R. Dawtrey...Peppering, Arundel
Drewitt, Thomas...Piccard's Farm, Guildford
Drewry, George...Newton-in-Cartmell, Lancashire
†Driver, George Neale...5, Whitehall, S.W.
†Druce, Joseph...Eynsham, Oxford
†Druce, Samuel...Eynsham, Oxford
†Drummond, A. R....Cadland, New Forest, Hants
Drummond, Dr. H...15, Westbourne Ter., Hyde Pk.
Ducane, Chas., M.P....Braxted Lodge, Witham
Duckham, T....Baysham Court, Ross, Herefordshire
†Duckworth, Sir J., Bart....Wear House, Exeter
†Duckworth, Russell...Murtrey Hill, Frome
Dudding, Thomas...Pockerby, Goole
Dudin, John B....Hayes Grove, Bromley, S.E.
Duffield, James...Great Baddow, Chelmsford
Dufty, Thomas...Knapthorpe, Newark
Dugdale, W. Douglas...West Chaldon, Dorchester
Duggan, H. Stephens...Hereford
Duke, Henry...Broadmain, Dorchester, Dorset

Duke, Stephen...Blakehurst, Arundel
Dumas, Francis Kuper...25, Fenchurch Street
Dumbrell, James, jun....Ditchling, Sussex
Duncan, W. G....Bradwell House, Stony Stratford
†Duncombe, Hon. O., M.P....Waresley, Biggleswade
Duncombe, Hon. W. E., M.P....The Leases, Bedale
†Duncombe, Sir P. P., Bart....Bletchley, Bucks
†Dun, Finlay...Weston Park, Shipston-on-Stour
†Dunn, Gen., R.E....Denford House, Hungerford
†Dunn, Thomas...1, York Gate, Regent's Park, W.
†Dunne, Thomas, jun....Bircher, Leominster
Dunnicliffe, W....Frowell, Nottingham
Duplessis, Jules...Newton Park, Lymington
Duppa, T. D....Longville, Shrewsbury
Du Pré, C. G., M.P....Wilton Park, Beaconsfield
Dupuis, Rev. G. J...Eton College, Windsor
Durant, Richard...Sharpham, Devon
Durham, Makin...Thorne, Yorkshire
Dyer, George...Wey House, Alton
Dyer, John...Hook Grange, Tichfield
Dyke, Sir P. H....Lullington Castle, Dartford, Kent
†Dyke, Rev. T. H...Long Newton, Stockton-on-Tees
Dyne, F. Bradley...4, Suffolk Street, Pall Mall East
Dyott, Col....Freeford Manor, Lichfield

E.

Eardley, Sir C. E., Bart....Belvedere, Erith, Kent
Eardley, R....Norton-in-Hales, Market Drayton
Eardley, Wm....Larkton Hall, Malpas
East, Sir Gilbert W....Hall Place, Maidenhead
†Easthope, Sir John, Bart....Fir Grove, Weybridge
†Easton, James...Nest House, Gateshead
Easton, James...Grove, Southwark, S.E.
Eastwood, R....Townley Brimshaw, Burnley
Eaton, Charles A....Tixover Hall, Stamford
†Eaton, George...Spixworth, Norwich
Eckley, Richard...12, Darlington Place, Bath
†Eddison, Edwin....Headingley Hill, Leeds
†Eddison, Francis...Adel Mill, Leeds
†Eddison, R. W....Headingley Hill, Leeds
†Eddison, William...Huddersfield
Edelsten, P....The Woodlands, Moseley, Birming.
†Eden, Hon. Wm. Geo....Doncaster
†Eden, J....Beamish Pk., Chester-le-Street, Durham
Eden, R....Bevington Green Ho., Hemel Hempstead
Edge, Davis...Outhill, Studley, Warwickshire
†Edge, James Thomas...Strelley Hall, Nottingham
†Edmonds, F. Ezek....Berryfield Ho., Bradford, Wilts
Edmonds, R....West Buckland, South Molton
Edmondson, John...Grassyard Hall, Lancaster
Edmunds, Edmund...Rugby
Edwardes, Frederick...Pilbroath, Carmarthen
Edwards, Francis...Pickeridge House, Slough
Edwards, Frederick...Barnham, Thetford
Edwards, Henry N....Broadwood, Leominster
Edwards, James L....Rochester, Kent
Edwards, Joseph...Hutton, Weston-super-Mare
Edwards, Joseph Priestley.. Fixby Park, Halifax
Edwards, Peter Norman...Brinsop Court, Hereford
Edwards, Robert V...Shottisham Hall, Woodbridge
†Edwards, Thomas....Wintercott, Leominster
Edwards, William...Crewe Arms, Crewe
Effingham, Earl of...Tusmore House, Bicester, Oxon
Egerton, Sir P. de M. G., Bt. M.P....Tarporley
Egerton, Lord...Tatton Park, Knutsford
Eggar, James...Brinsted, Alton
Egginton, S. H....North Ferriby, Brough, Yorkshire
Ekin, Thomas...Newmarket
†Eland, S. E...ManorHo., Stanwick, Higham Ferrers
Elcho, Lord, M.P....Armisfield, Haddington, N. B.
Eley, Charles...Beavers Farm, Hounslow, W.
Eley, W.H., jun...Islingham, Frindsbury, Rochester
Elkington, H....Woodbrooke, Northfield, Birming.
†Elkins, J. N...Elkington, Welford, Northamptonsh.
†Elliot, John...Chapel Brampton, Northampton
Elliot, John Lettson...The Brewery, Pimlico, S.W.
Ellis, Charles...Franklands, Hurstpierpoint
Ellis, Charles...Meldreth, Royston, Cambridge
Ellis, Job...Oswestry
†Ellis, John...Artington, Guildford
Ellis, I. P....The Field, Hampton Bishop, Hereford
†Ellis, Robert Ridge...Yalding, Kent
Ellison, Charles...Oldbury Lodge, Bridgnorth
Ellison, Francis Charles...Low Sizergh, Milnthorpe
Elliston, B. A....Croydon Arrington, Cambridge
Ellman, R. H....Landport, Lewes
Ellman, Thomas...Beddingham, Lewes
Elmhirst, Rev. E....Shawell Rectory, Rugby
†Elmsall, Mansfeldt de C....The Club, York
Elorza, General da Francisco...Tubia, Oviedo
†Elston, Capt. W....St. Ann's Rd., North Brixton, S.
Elton, Sir E. M., Bt....Widworthy Court, Honiton
Elton, Major Robert James...Whitestanton, Taunton
Elvidge, Benjamin...Leven, Beverley
Elwes, John H....Colesburn House, Cheltenham
Emery, E. Crosswiller...Storrington, Sussex
Emery, R. Coleman..Hurston Pl., Storrington, Sus.
Emson, H. H....Nether Hall, Cherry Hinton, Camb.
†Enfield, Viscount...Wrotham Park, Barnet
England, Richard...Binham, Wells, Norfolk
Enniskillen, Earl of....Florence Court, Fermanagh
Ensor, John...Dorchester, Dorset
†Entwistle, John S....Foxholes, Rochdale
Enys, John Samuel...Enys, Penryn, Cornwall
Epton, W. M....Langton Wragby, Lincolnshire
†Erkoig, Adolphus...Derekegyhaza, Pesth, Hungary
†Erle, Rev. Christopher...Hardwicke, Aylesbury
Erle, Rt. Hon. Sir W., Kt...Bramshot Grange, Liphook
Ernest, Henry...4, Whitehall, S.W.
†Errington, Rowland...Sandon, Hexham
Esdaile, W. C. D....Burley Park, Ringwood, Hants
†Estcourt, E. D. B....Newnton House, Tetbury
Etches, Wm....Beech House, Newcastle, Staffs.
Ethelstone, Rev. C. W....Up Lyme, Lyme Regis
†Euston, Earl of...Euston, Thetford
Evans, E. M....Llynbarried, Nantmel, Kington
Evans, Edward...Boveney Court, Windsor
Evans, George...Wimborne, Dorset
†Evans, Henry J....Bank, Cardiff
Evans, H. Rawlings, jun....Dilwyn, Leominster
Evans, Isaac Pearson...Griff, Nuneaton
Evans, James Eaton...Haverfordwest
Evans, John...Uffington, Salop
Evans, R. P....Orpines, Wateringbury, Maidstone

†Evans, R. W.... Eyton Hall, Leominster
Evans, Samuel... Darly Abbey, Derby
Evans, Thos. M... West Hill, Wandsworth
Evans, Capt. T. B.... Deane House, Enstone, Oxon
†Evans, Rev. W. E.... Burton Court, Herefordshire
Everett, Frederick... Shaw Rectory, Newbury, Berks
Everington, William, jun.... Skegness, Boston
†Everington, Wm. D.... Plumstead House, Norwich
Everitt, James... North Creake, Fakenham
Evershed, Henry... Park Hall, Gosfield, Halstead
Evershed, John.... Albury, Guildford
Ewen, Thomas L'Estrange... Dedham, Colchester
Ewings, Wm... London and Westm. Bank, Lothbury
Exall, W.... Kates Grove Works, Reading, Berks
Exley, Wm. H.... Wisbeach, Cambridgeshire
Eyke, John... Stanton, Shiffnal
†Eyre, G. E.... Warrens, Stoney Cross, Southampton
Eyre, Henry R.... Shaw House, Newbury
Eyre, Martin... 17, Bellevue Terrace, Hull
Eyre, R. T.... Bartley, Totton Wear, Southampton
†Eyres, Capt. Harry... Knockwood Park, Tenterden
Eyton, John Wynne... Lee's Wood, Mold, Flintshire
†Eyton, Thos. C.... Vineyard, Wellington, Shropsh.

F.

Faber, C. Wilson... Northaw House, Barnet
Fair, J.... Warton Lodge, Lytham, Preston, Lancas.
Fairbairn, George... Holmes Chapel, Cheshire
Faithful, Rev. G. D.... Lower Heyford, Oxford
Falmouth, Viscount... Mereworth Castle, Maidstone
Fane, Cecil... 4, Upper Brook Street, W.
†Fardon, H. F.... The Firs, Bromsgrove
†Farhall, J. N.... Tillington, Petworth
Farley, Rev. C. Turner... Moorhall, Stourport
†Farmer, Archibald H.... Harefield, Cheam, S.
Farmer, Edward... Fazeley, Staffordshire
Farnworth, J. K.... Alderley Edge, Manchester
Farnworth, Thos. M.... Alderley Edge, Manchester
Farnham, E. B..... Quorndon House, Loughborough
†Farr, Richard... Wormesley Grange, Herefordshire
†Farr, Wm. Wyndham... Iford, Christchurch, Hants
Farrell, Edward... Tan-y-lan, Holywell
†Farrer, Edmund... Sporle, Swaffham
Farrer, James... Ingleborough, Settle
†Farrer, O. W.... 1, Hamilton Place, Piccadilly, W.
Farthing, Walter... Stowey Court, Bridgwater
Faulkner, C. F. A.... Bury Barnes, Burford, Oxon
Faulkner, John... Bretby Farm, Burton-on-Trent
Faviel, George... Amcotes Lodge, Goole
Faviell, J. Brown... Stockwell Park, Wetherby
†Faviell, Mark, jun....
Faviell, William Fred.... Down Place, Guildford
Fawcett, John... Durham
Fawkes, F. H. .. Farnley Hall, Otley
Featherstone, Wm.... Sunley Hall, Kirby-Moorside
Featherstonhaugh, R... Rockview, Killucan
Feilden Captain H. M.... Bank Hall, Clitheroe
Feilden, Captain J.... Witton Park, Blackburn
Feetham, John... Great Burdon, Darlington
Felgate, W... 9, Westbourne Cres., Hyde Pk. Gardens
†Fellowes, Jas.... 29, Gloucester Place, Portman Sq.
Fellowes, Robert.... Bitteswell Hall, Lutterworth
Fellowes, Rev. T. L.... Beighton Rectory, Acle
Fellows, W. Manning... Ormsby, Great Yarmouth
†Felton, Clement... Dunton, Fakenham
Fenton, John T... Waterloo Colliery, Leeds
†Fenwick, Henry, M.P... Southill, Chester-le-Street
†Ferard, Charles Colton... Ascot Place, Windsor
Ferrabee, Jas... Phœnix Ironworks, Stroud, Gloucest.
†Ferris, T.... Manningford Bohune, Pewsey, Wilts
†Ferris, William... Draycot, Pewsey, Wiltshire
Festing, R. G.... 1, Queen Sq. Place, Westminster
Ffooks, Thomas... Sherborne
†Ffoulkes, Major John J.... Llandyssil, Shrewsbury
Fiddes, Thomas F.... Towneley Lodge, Burnley
Field, George... Ashurst Park, Kent
†Field, Henry... East Lodge, Tulse Hill, S.
Field, James Pope... Shipton-on-Cherwell, Oxford
Field, Samuel... Farnsfield, Southwell
†Field, William... 224, Oxford Street, W.
Field, William David... Swan Hill, Shrewsbury
†Fielden, Joshua... Stansfield Hall, Todmorden
†Fielden, S.... Centre Vale, Todmorden
Fieldsend, C., jun.... Kirmond, Binbrook, Lincolnsh.
Filliter, George... Trigon Hill, Wareham, Dorset
†Filmer, Sir E., Bt., M.P... East Sutton Pk., Staplehst.
Finch, J.... 1, Adelaide Place, London Bridge, E.C.
†Finch, Rev. W.... Warboys, Huntingdonshire
Finchett, Thomas... Rushton, Tarporley
†Findlay, John... Garnstone, Hereford
Findlay, T. Dunlop... Easter Hill, Glasgow
Finlay, Alex. J.... Castle Toward, Greenock
†Finnis, Steriker... The Elms, Hougham, Dover
Firth, Samuel... Burley Wood, Leeds
Firth, William... Burley Wood, Leeds
Fisher, James... Adelaide
Fisher, John... Carrhead Farm, Cross Hills, Leeds
Fisher, T. Forest, Ince Blundell, Liverpool
Fison, Cornell... Thetford
†Fison, John Potterton... Horningsea, Cambs.
†Fitzgerald, Maj. H. T. G... Maperton Ho., Wincanton
Fitzgerald, Wm. Seymour.... Holbrook, Horsham
Fitzherbert, William... Somersal Herbert, Uttoxeter
†Fitzhugh, Thomas Lloyd .. Plas Power, Wrexham
Fitzhugh, Rev. Wm.... Street, Lewes
Fitzpatrick, Rt. Hon. J. W.... Abbeyleix, Ireland
Fitzroy, Lt. Col. H.... Stratton Strawless, Norwich
Fitzroy, George... Grafton-Regis, Stony Stratford
†Fitzwilliam, Hon. C. W.... Alwalton, Peterborough
Fitzwilliams, E. C. L.... Newcastle Emlyn, S. W.
†Fletcher, Lt.-Col. E. C... Kenward, Yalding
Fletcher, George... Shipton, Cheltenham
Fletcher, John Charles... Dale Park, Arundel
Fletcher, John Lynch... Streatley, Reading
†Fletcher, J. P.... Ashley Park, Walton-on-Thames
Fletcher, William... Radmanthwait, Mansfield
Flower, Charles Henry... France Farm, Blandford
Flower, G. F. A... Stafford Farm, Dorchester
Floyd, Thomas... Frilford, Abingdon
Floyer, John... Hints, Tamworth
†Floyer, John... Stafford, Dorchester
Floyer, John Wadham... Martin, Horncastle
†Foljambe, Geo. Saville... Osberton House, Worksop
Folkstone, Viscount... Longford Castle, Salisbury
Fookes, H.... Whitechurch Farm, Blandford

Forbes, John M....Dropmore, Maidenhead
Forbes, Sir John Stuart, Bart....Fettercairn, N.B.
Ford, J., jun....Rushton Farm, Blandford
Ford, William...Brinsop, Herefordshire
Fordham, Edward...Royston, Cambridgeshire
Fordham, Edward King...Ashwell, Baldock
Fordham, John George...Royston
Forester, G. T....Ercall Magna, Wellington, Shrops.
Forester, Rev. R. T....Elmsley Lodge, Leamington
Forrest, Thomas...Spurston Hall, Tarporley
Forrester, George...Tombland, Norwich
†Forrester, Jos. James...24, Crutched Friars, E.C.
Forster, Abraham T....Garretstown, Kinsale
†Forster Charles...Hanch Hall, Lichfield
Forster, R. C....White House, Gateshead
Forster, Robert...Tottenham Green, N.
†Forster, Samuel...Southend, Sydenham, S.E.
Forsyth, James...Sorne House, Tobermary, Argylls.
Fort, George...Alderbury House, Salisbury
Fortescue, Hon. G....Boconnock, Lostwithiel, Cornw.
Foster, Edward...Waterton Hall, Goole, Yorkshire
Foster, J....Ledsham, Milford Junction
Foster, J. P....Killhow, Wigton, Cumberland
†Foster, John James...Mansion Street, Lincoln
†Foster, Richard...Castle, Lostwithiel, Cornwall
Foster, Wm....Canwick House, Lincoln
†Foster, William...Stourton Court, Stourbridge
†Foster, W. O., M.P....Stourton Castle, Stourbridge
Fothergill, James...Beeston, Nottingham
Fothergill, John...Nottingham
Fothergill, Matthew...Cefnrhychdir, Newport, Mon.
Fothergill, R....Hensol Castle, Cowbridge, S.Wales
†Fountaine, Bernard T....Stoke House, Bletchley
Fowle, W....Market Lavington, Wiltshire
Fowler, Benj....Whitefriars Street, Fleet Street, E.C.
Fowler, Charles...Whitelands, Bicester
Fowler, John K., jun....Aylesbury
Fowler, M....Little Bushy Farm, Stanmore, N.W.
†Fowler, Robert C....Gunton Hall, Lowestoft
Fowler, R., jun....14, Bennett's Hill, Birmingham
Fowler, Francis...Henlow, Baldock
Fowlie, Wm....
Fox, Alfred Lloyd...Manure Works, Penrhyn
†Fox, Chas. B....Malpas, Newport, Monmouthshire
Fox, Frederick F....Melbourne, Derby
†Fox, G. Lane...Bramham Park, Tadcaster
Fox, Robert...Falconhurst, Cowden, Kent
Fox, W....Elfordleigh, Plympton St. Mary, Devon
Fox, William...Dunston, Sleaford
Frampton, Henry...Okers Wood, Dorchester
Francis, Clement...Quy Hall, Cambridgeshire
Francis, Frederick...Warley Place, Brentwood
Francis, S. R. G....Cranham Place, North Ockendon
Franklin, Edward L....Ascott, Wallingford
Franklin, John...Ewelme, Wallingford
†Franklin, Richard...Clemenstone, Bridgend
Franklin, Robert...The Park, Thaxted
Franks, George...Thong, Gravesend
Franks, James...Bramley, Guildford
Franks, Thomas...Westfield, Montrath
Fraser, Hugh...Culloden, Inverness
Frederick, Sir R., Bt...Burwood Pk., Walton-on-Th.
†Freebody, Wm. Y...Trafalgar Pl. W., Hackney Rd.
Freeman, John Gardner...Rockfield, Hereford
Freeman, Thos....Henham, Wangford
Freeman, Joshua...Ashford, Staines
Freeman, W. P. W....
French, Richard Day...St. John's, Bungay
†Frere, G. E....
Frere, P. H....Regent Street, Cambridge
†Frost, Chas....Wherstead, Ipswich
Frost, Edward...West Wratting Hall, Linton
†Fry, James Thomas...Boston, Bromley, Kent
Fry, Thomas...Baglake Farm, Dorchester, Dorset
†Fryer, H. C....Lodge Park, Taliesin, Shrewsbury
Fryer, W. Fleming...The Wergs, Wolverhampton
†Fryer, W. R....South Lytchett House, Poole
Fulcher, Thomas...Elmham Hall, Thetford
Fulford, Baldwin...261, High Street, Exeter
Fuller, F. G....Maidenhead
Fuller, Robert Mills...Croydon, S.
Fulljames, Thos....Hatfield Court, Gloucester
Fulshaw, Richard...Bushby House, Leicester
Furneis, John...Coxhoe, Ferryhill, Durham
Furniss, Laur....Birchill Farm, Baslow, Chesterfield
Furnival, S....Napeley Heath, Market Drayton
Fussell, Rev. James G. C....Chantry, Frome
†Fytche, J. Lewis...Thorpe Hall, Elkington, Louth

G.

Gadesden, Augustus W....Leigh House, Tooting, S.
Gaisford, Major T....Baystone, Chipping Sodbury
Gale, Chas. J....Kilnocks, Botley, Hants
Galpin, George...Kingston Farm, Dorchester
Galpin, John...Dorchester
Galpin, Thomas P....Little Langford, Heytesbury
†Galton, Darwin...Claverdon Leys, Warwick
†Galway, Viscount, M.P....Serlby Hall, Bawtry
†Gamble, D....Gerard's Bridge, St. Helen's, Lanc.
Gamble, Thomas...Canwick Road, Lincoln
†Gamlen, Wm. H....Hayne House, Tiverton
†Gammie, Geo....Shotover House, Wheatley, Oxon
Gandy, Lt.-Col....Heaves, Milnthorpe
Garbatt, Thomas...Yarm, Cleveland
†Gard, R. Sommers...Rougemont House, Exeter
Garde, T....Ballinacurra, Midleton, co. Cork
Gardner, Francis...Ryburgh, Fakenham
Gardner, Thos. K....Leighton, Ironbridge, Salop
Gardner, William Nettleton...Wells, Norfolk
Gardnor, Capt. T....Sea View, Ryde, Isle of Wight
†Gardom, T. W....The Yild, Baslow, Chesterfield
Garmston, John...Worcester
Garne, George...Churchill Heath, Chipping Norton
†Garne, John...Filkens, Lechlade
†Garne, Robert...Aldsworth, Northleach
†Garne, Wm....Kilkenny Farm, Bibury, Fairford
Garnett, William...Clitheroe
Garnett, W. J., M.P....Bleasdale Tower, Garstang
Garney, Charles...Kenton, Dedham, Suffolk
†Garratt, John...Bishop's Court, Exeter
Garrett, Richard...Carlton Hall, Saxmundham
Garrold, R. H....Kilforge, Ross
Garsed, John...The Moorlands, Cowbridge
Garth, T. C....Haines Hill, Reading
Gascoyne, Wm....Bapchild Court, Sittingbourne

Gascoyne, William Whitehead...Sittingbourne
†Gaskell, Henry L....Kiddington Hall, Woodstock
†Gatacre, Edward L....Coton, Kidderminster
Gater, John...West End, Southampton
Gates, John A....Grange Farm, Sapiston, Ixworth
†Gates, R....7, Sussex Place, Horsham
Gatrell, William Verling...Lymington, Hampshire
Gatty, George...Felbridge, East Grinstead
Gaudern, J....Earl's Barton, Wellingborough
Gauntlett, W. H...Eston Junct.,Middlesbro'-on-Tees
†Gauthorp, Henry...Widness, Warrington
†Gawne, Edw. Moore...Kentraugh, Isle of Man
†Geary, Sir W. R. P., Bt....Oxen Heath, Tunbridge
Gedge, Johnson...Bury St. Edmund's
Gee, Thomas...Brothertoft, Boston
Geldard, Chris., jun....Cappleside, Settle
Gelderd, George A....Aikrig End, Kendal
George, Thomas...Bythorne, Thrapstone
George, T. Willington...Bellevue House, Leeds
†German, George...Measham Lodge, Atherstone
Gervis, Sir G. E. M. T., Bt....Christchurch, Hants
Gibb, James...Crown Villa, Southport
Gibb, John...
Gibbon, A...Staunton, Coleford, Gloucestershire
Gibbens, Edward...Minster, Isle of Thanet
Gibbons, Henry...Hampton Bishop, Hereford
Gibbons, Stephen...Brocklesby Park, Ulceby
†Gibbs, George...Belmont, Bristol
†Gibbs, Hen. H...St. Dunstan's, Regent's Pk., N.W.
Gibbs, Robert...Carhampton, Dunster
Gibbs, Thomas...26, Down Street, Piccadilly, W.
Gibbs, W....Alveston Hill, Stratford-upon-Avon
Gibbs, Wm....Tyntesfield Bourton, Bristol
Giblett, John...Lower Clapton, N.E.
Gilbert, Henry...Barnby Manor, Newark, Notts
Gilbert, James...23, Anne Street, Birmingham
†Gilbert, R....Ashby Hall, Berghapton, Norfolk
†Gilbert, Thomas W....The Close, Salisbury
†Gilbert, William A....Cantley, Acle
Gilbertson, M....Elm Cottage, Egham Hill, Surrey
Giles, Henry, jun....Great Clacton, Essex
Gill, George...Weston, Shrewsbury
Gill, Joseph...Leeds
Gillett, Charles...Cote House, Bampton, Oxon
Gillett, John...Fawler, Charlbury
Gillett, John...Minster Lovel, Witney
Gillett, Thomas...Kilkenny, Faringdon
Gilpin-Brown, G...Sodbury Park, Richmond, Yorks.
Gilstrap, William..Fornham Pk., Bury St. Edmunds
Ginders, Samuel...Ingestre, Stafford
Giraud, Edward...Preston, Wingham
†Gladstone, Capt.,M.P....Bowden Pk.,Chippenham
Glaisier, William Richard...41, Charing Cross, S.W.
Gleed, Ellis L....Hoo Hall, Wickham Market
Glegg, J. B....Withington Hall, Chelford, Congleton
Glegg, Lt.-Col. E. Holt...Backford Hall, Chester
Glen, G....Stratton Audley Park, Bicester
†Glendining, Alexander...Red Leaf, Penshurst
Glenton, Frederick...Bensham, Newcastle-on-Tyne
Glover, John...Bangley, Tamworth
Glover, Robert...Wexford, Lichfield
Glynne, Rev. Henry...Hawarden Rectory, Chester
Glynne, Sir S., Bt., M.P...Hawarden Castle, Flintsh.

†Gobbitt, John...Wickham Market, Suffolk
Goddard, H. N...Manor Ho.,Clyffe,Wootton-Bassett
Goddard, Thomas...St. Fagans, Cardiff
Goddard, Wm. Gibert...Broad Chalk, Salisbury
†Goddard, William R....Somerset House, W.C.
†Godsal, Philip Wm...Iscoyd Pk., Whitchurch,Salop
Godwin, William...Lugwardine, Hereford
Goggs, James...Great Baddow Park, Chelmsford
†Goldhawk, R., jun....Hasle Hall, Steer, Guildford
Goldsmith, Thomas...Dairy Farm, Ixworth
Gomm, Gen. Sir W. M....New St., Spring Gardens
†Gonne, Charles...Warley Lodge, Brentwood
Gooch, John Kerr...East Tuttenham, Norwich
†Gooch, John Virel...Reform Club, Pall Mall, S.W.
Gooch, Stephen...Honingham, Norwich
Goodchild, Philip P....Rectory, Hackney, N.E.
†Goodden, John...Over Compton, Sherborne, Dorset
†Goodhart, Charles E....Langley, Beckenham
†Goodlake, F. Mills...Wadley Ho., Faringdon
Goodson, Wm....Hill Farm, Mitcham, S.
Goodwin, J....Central Farmers' Club, Blackfriars
Goodwin, Ralph Willis..Burnham Abbey, Maidenh.
Goody, Golden...Broom House, Chapel Halstead
Gordon, Charles...Heavitree, Exeter
Gordon, R....Kemble House, Cirencester
Gosford, Vincent...Tan-y-llan, Holywell, Flintshire
Gosling, John...Brewery, Bocking, Essex
Gosling, Robt...Hassobury, Bishop's Stortford, Herts
Gosling, Thomas G....15, Portland Place, W.
†Gosset, Capt. Arthur...Eltham, Kent
Goucher, John...Woodsetts, Worksop
Gough, Edward...Gravel Hill, Shrewsbury
Gould, John...Hyde Hall, Denton, Manchester
Gould, Joseph...Newhall, Broadclist, Devon
Gould, Rev. Joseph...Hurst Green
Gouldbourne, Joseph...Wilkesley, Whitchurch
Goulding, Wm....108, Patrick Street, Cork
Gouthwaite, Richard...Lumby, Milford Junction
†Gow, James...Fowler's Park, Hawkhurst, Kent
†Gower, A. L....Castle Malgwyn, Newcastle Emlyn
Gower, Andrew...Market Drayton
†Gower, Erasmus...Clynderwen, Narberth, S.W.
†Gower, J. Leveson...Westwood, Colchester
†Gower, Robt. F....Clynderwen, Narberth, S.W.
†Gower, G. W. G. L....Titsey Pk., Godstone, Surre
Grace, Wm....Park Road, Newcastle-on-Tyne
Graham, Alexander...Barnston, Birkenhead
†Graham, James...Beaulieu, Southampton
Graham, James...York Road, Leeds
Graham, Walter...West Drayton, Uxbridge
Graham, William, jun....Abingdon
Graham, Wm., jun....Newport, Monmouth
Grain, Peter...Shelford, Cambridge
Grant, John...Albion Place, Maidstone
Grant, William...Litchborough, Weedon
†Grantham, George...Hove
Grantham, Rev. Thos....Bramber, Steyning
†Granville, Earl...Aldenham, Bridgnorth
Graves, Robert...Charlton, Shaftesbury
†Gratwick, W. G. K....Ham, Arundel
Gray, Rev. John D....Abbotsley Vicarage, St. Neot's
†Gray, Jonathan...Sion Hill, Bath
Gray, William...Kingston, Drem, N.B.

Grazebrook, George...The Race Course, Stourbridge
Greaves, Edward, M.P....Barford, Warwick
Greaves, William...Bakewell, Derbyshire
Green, Rev. G.W...Court Henry, Dryslwyn, Carmar.
Green, Joseph B....Marlow, Leintwardine
Green, Robert...Milford House, Derby
Green, Rev. Thomas...Vicar of Badby, Daventry
†Greenall, G., M.P....Walton Hall, Warrington, Lanc.
Greene, E....West Gate, Bury St. Edmund's
†Greene, Harry A....Crown Street, St. Ives, Hunts.
†Greene, Thomas...Whittington Hall, Lancaster
Greene, Wm....Ditcham Park, Petersfield
Greenwood, Charles...Wallingford, Berkshire
†Greenwood, Fred....Norton Conyers, Ripon
†Greenwood, J., M.P....SwarcliffeHall, Ripley, York
Greenwood, R....Towse Ho., Ludford, Market Rasen
Greetham, Thomas...Stainfield Hall, Lincoln
Greetham, William...Stainfield Hall, Wragby
Gregg, James...Ledbury
†Gregg, Thomas...
†Gregor, Gordon W.F...Trewarthenick, Grampound
Gregory, George...Crowhurst, Battle
Gregory, J....Shavington Park, Market Drayton
Gregory, J. S....Bramcote Hills, Nottingham
Gregson, Brian Paget...Caton, Lancaster
†Gregson, Matthew...Toxteth Park, Liverpool
Grenfell, Arthur Riversdale...Travellers' Club, S.W.
Grenfell, Chas. P., M P....38, Belgrave Sq., S.W.
Grenfell, Riversdale W....Ray Lodge, Maidenhead
†Grenville, Ralph N....Butleigh Ct., Glastonbury
Gresswell, Dan....Louth
Greville, Col. Fulke S...North Mimms Park, Hatfield
†Grey, Rt. Hon. Sir G., Bt., M.P...Fallowdon, Alnwick
†Grey, Hon. Brow. N. Osborn De...Watton, Norfolk
†Grey, Capt. Hon. F. W., R.N....Howick, Alnwick
†Grey, Hon. & Rev. F. De...Copdock Recty., Ipswich
†Grey, Hon. G. De...11, South Audley Street, W.
Grey, Jas....Kimmerston, Wooler, Northumberland
Grey, John...Dilston House, Gateshead
Griffin, Alfred E....Wolverhampton
Griffin, Clement W....Werrington, Peterborough
Griffin, Edward...Towersey, Thame
Griffin, John...Borough Fenn, Market Deeping
Griffin, Fred. C....Methwold, Brandon, Norfolk
Griffith, C. Darby...Padworth House, Reading
Griffith, Edw. H....Plas-Newydd, Trefnant, Rhyl
Griffith, J...Llwynduris, Newcastle-Emlyn
Griffith, Samuel Y....Star Hotel, Oxford
Griffithes, Thomas J....Bishop's Castle, Salop
Griffiths, Edward...New Court, Hereford
Griffiths, John...The Weir, Hereford
Grinstone, Lt.-Col. Oswald A...Yeatton, Leamington
†Grissell, Thos...Norbury Park, Mickleham, Surrey
†Grisewood, H....Daylesford Ho., Chipping Norton
Grosvenor, Earl, M.P....28, Princes Gate, S.W.
Grove, James...Great Baddow, Chelmsford
Grove, Philip...Eastcote, Towcester
Grundy, E. S....Reddish Hall, Lymm, Warrington
Grylls, Capt. Glynn...
Gubbins, John Panton...
Gubbins, Joseph...Kilfrush, Knocklong, Limerick
Guilding, Richard...Malvern Wells
Gulliver, Wm. H....Collingborne, Marlbro'
Gulston, Alan James...Woodland Castle, Swansea
Gunner, William...Will Hall, Alton
†Gunter, Captain Robert...Wetherby
†Gurdon, J. B....Assington Hall, Boxford
†Gurdon, Brampton...Letton Hall, Shipham, Norf.
†Gurdon, Rev. P....Cramworth Rectory, Shipham
†Gurdon-Rebow, J....Wivenhoe Pk., Colchester
†Gurdon, William...Brantham, Manningtree
Gurney, Jason...Hounslow
†Gurney, John Henry, M.P....Easton, Norwich
†Gurney, Russell...8, Palace Gardens, Hyde Pk., W.
Gurney, Samuel...Carshalton, S.
†Guthrie, John...Guthrie Castle, Forfarshire
Gwyn, H., M.P....Dyffryn, Neath, Glamorganshire
Gwyn, Rich. H....Astbury Hall, Bridgnorth, Salop
Gwyn, Wm. Edw....Plas Cwrt Hyrs, Carmarthen
Gyles, John...Aplayhead, East Retford, Notts

H.

Hack, James Carter...Springfield, Chelmsford
Hacker, John Heathcote...Leek, Staffordshire
Hadden, A....The Old Parks, Ashby-de-la-Zouch
Hagen, Jacob...Ropley House, Alresford
Haggard, Wm. M. R....Clarendon Sq., Leamington
Hagger, Franklin...Hertford
†Haig, J. H....Highfields Park, Wythiham, Sussex
Haines, Edward...Moorwood House, Cirencester
Hainworth, William...Hitchin
Hale, Chas. C....Glenlochay, Killrie, Perthshire
Hales, Edward...North Frith, Hadlow, Kent
Halford, Charles...Newbold Mill, Worcestershire
Halford, Thos....Kerry, Newtown, Montgomerysh.
Halford, T....Newbold-on-Stour, Shipton-on-Stour
Halkett, Rev. D....Rector of Little Bookham, Surrey
Halkett, Peter Alexr....142, High Holborn, W.C.
Hall, Alexander Hall...Watergate, Emsworth
Hall, Benjamin...Wood Farm, Malvern Wells
Hall, Charles...Ewell, S.
Hall, Collinson...Navestock, Romford, E.
Hall, Francis...Park Hall, Mansfield
Hall, George...Garford, Yarkhill, Ledbury
†Hall, Henry...
†Hall, Henry...Barton, Woodstock
Hall, Henry...Alton
Hall, James...Scarborough Hall, Beverley
†Hall, John...Wiseton, Bawtry
Hall, J.O....1, Brunswick Row, Queen's Sq., W.C.
Hall, John...Sibthorpe, Newark-on-Trent
Hall, Major-Gen....Carlton Club, Pall Mall, S.W.
†Hall, Marshall...Blacklands Park, Calne, Wilts
Hall, Richard...Raglan House, Neath, Glamorgansh.
Hall, T....Duke's Oak, Brereton, Congleton
Hall, Thomas K....Holly Bush, Burton-on-Trent
†Hall, William...Ashton, Leominster
Hallam, John...Newcastle, Staffordshire
Hallam, Thos....Bridlesmith Gate, Nottingham
Hallett, Fred. Fran....The Manor House, Brighton
Hallowes, Thomas...Glasswell Hall, Chesterfield
†Halls, Joseph...Denham Hall, Bury St. Edmund's
†Halliday, J....Chapel Cleeve, Taunton
Halliday, Thomas C....Red Hill, Barstow, Horley

Halse, J. C.... Pulworthy, Molland, South Molton
Halse, Philip... Molland, South Molton
Halsey, Rev. J. F. Moore... Hemel Hempstead
Halsey, Thomas... Compton House, Newent
Halsted, Thomas... Woodcote, Chichester
Halton, Rev. Immanuel... Winfield Manor, Alfreton
†Hambro, Charles... Milton Abbey, Blandford
†Hambrough, Albert J.... Steep Hill Castle, Ventnor
Hamersley, Hugh... Great Haseley, Tetsworth
†Hamilton, Capt. Archibald... Rozelle, Ayre
Hamilton, Chas. W.... Hamwood, Dunboyne, Ireland
†Hamilton, John... Sundrum, Ayr, N. B.
†Hamilton, John... Hilston Park, Monmouth'
†Hamilton, Sir R. N. C., Bt., K.C.B... Park Steet, W.
†Hamilton, Wm. M.... 2, Orchard Place, Canterbury
Hammerton, Charles... Princethorpe, Warwickshire
Hammond, Horace John... Chapel Farm, Eltham
†Hamond, W. Parker... Pampisford Hall, Cambridge
Hampton, George... Findon Park Farm, Worthing
†Hanbury, E.... Eastrop House, Highworth
Hanbury, Robert... Poles, Ware, Herts
Hancock, Abraham... Little Grove, Ropley, Alresford
Hancock, J. Donne... Halse, Taunton
Hancock, T.... Staplefield Common, Crawley, Sussex.
Hand, James... Ludlow, Shropshire
†Handley, Maj. Benj.... Folkingham, Lincolnshire
Handy, Edward... Sierford, Cheltenham
Hanmer, Col. H.... Stockgrove, Leighton Buzzard
Hanmer, Sir J., Bt., M.P... Bettisfield Pk., Whitchurch
Hannam, Charles... Northbourne Court, Deal
Hannam, Henry J.... Burcote, Abingdon
Harbin, George... Newton House, Yeovil
Harcourt, Colonel Francis V.... 5, Carlton Gardens
Harcourt, Admiral Octavius... Swinton Park, Bedale
†Hardacre, Richard... Hellifield, Leeds
†Hardcastle, Jonathan... Abberley Hall, Stourport
Harding, Egerton W.... Old Springs, Market Drayton
Harding, George... Durweston, Blandford
†Harding, John... Dursley, Gloucestershire
Harding, James... Waterson, Dorchester
Harding, S. T.... Stinsford Farm, Dorchester
Harding, Wm. C.... Lower Winchendon, Aylesbury
Hardinge, Edm. S.... Bounds Park, Tonbridge Wells
Hardstaffe, Dodson... West Leak, Loughboro'
Hardwick, Alfred... Hangleton, Shoreham
Hardy, James... Jaques Hall, Manningtree
†Hardy, John... Dunstall Hall, Burton-on-Trent
Hardy, Richard... Marchington, Uttoxeter, Staff.
†Hardy, W. H. C.... Letheringsett Hall, Holt, Norfolk
Hardy, William Thistleton... Market Overton
Hare, Humphrey John... Docking Hall, Norfolk
Hare, Joseph... Wilton Farm, Beaconsfield
†Hare, Sir J., Bart.... 12, Pall Mall East, S.W.
Hare, Sir Thos., Bart.... Downham Market, Norfolk
†Harewood, Earl of... Harewood House, Leeds
†Harford, J. B.... Stoke House, Stoke Bishop, Bristol
†Harford, John Scandrett... Blaize Castle, Bristol
†Harford, W.... Barley Wood, Wrington, Bristol
Harker, James... Tibshelf, Alfreton
Harker, Rev. Wm.... Worcester
Harkes, William... Lostock, Knutsford
Harland, W. C.... Sutton Hall, York
†Harman, Hon. L. K.... Ballymena, co. Longford
†Harper, Latimer... Chilton Cottage, Hungerford
Harries, Francis, jun.... Cruckton Hall, Shrewsbury
Harrington, Earl of... Elvaston Castle, Derbyshire
†Harris, Lord... Belmont, Faversham
Harris, Richard... Wootton Grange, Northampton
Harrison, John... Summerlands, Kendal
Harrison, J., jun... Snelston Hall, Ashbourne, Derbys.
Harrison, J., jun.... Heaton Norris, Stockport
Harrison, J. T... Frocester Court, Stonehouse, Glouc.
†Harrison, Richard... Wolverton, Stony Stratford
Harrison, Rev. R. J... Caerhowell, Garthmyl, Shrewsb.
Harrison, Rev. J. H.... Bugbrooke Rectory, Weedon
Harrison, William H.... Oxendon, Northamptonsh.
Harrowby, Earl of... Norton Ho., Campden, Glouces.
Hart, Henry P.... Beddingham, Lewes
Hart, Thomas... Ascott, Leighton Buzzard
†Harter, Rev. G. G.... Cranfield, Newport Pagnell
†Harter, Jas. Collier... Broughton Hall, Manchester
Hartley, Gilferd Wm.... Rosehill, Whitehaven
Hartshorn, Thomas... Silkmore House, Stafford
Harvey, Chas. W.... Royal Bank Buildings, Liverpool
Harvey, Edw. N.... Mount Ho., Hythe, Southampton
†Harvey, Richard... Greenaway, Torquay
Harvey, Richard Hart... Harroldston, Haverfordwest
Haslam, Charles... Basingstoke
Haslar, Richard... Aldingbourne, Chichester
†Harsall, Geo.... Shelford Manor, Ratcliffe-on-Trent
Hassall, Wm.... Babney, Whitchurch, Salop
Hatfield, Chas. Taddy... Hartsdown House, Margate
Hatfield, Thomas... St. Martin's, Stamford
Havers, William... Bacon's Farm, Mountnessing
Harward, John... Chaddesley Corbet, Kidderminster
Haward, R.... Mells Hill, Halesworth
Hawarden, Viscount... Dundrum Castle, Cashel
Hawkesley, Archibald... Englefield Green, Surrey
†Hawkesworth, R. S... Forest, Mountrath, Queen's co.
Hawkins, H. M.... Tredunnock, Usk, Monmouthsh.
†Hawkins, T.... Smallbridge, Bures St. Mary, Suffolk
†Hawkins, Thos., jun.... Sugwas, Hereford
Hawks, George... Gateshead Iron Works, Gateshead
Hawthorn, W.... Benwell Cottage, Newcastle-on-Tyne
Hawxwell, Alfred... Thirsk
†Hay, C. Anderson.. 17, York Ter., Regent's Pk., W.
Hay, G. W.... Sudbury, Derbyshire.
Haydon, Samuel... Guildford
Hayes, Henry... Stamford
Hayes, John Higson... Frodsham
†Hayne, John... 24, Gloucester Sq., Hyde Park, W.
Hayne, Col. Richard...
Hayter, Tom John... West Woodgates, Salisbury
Hayward, H. S.... Folkington, Willingdon, Sussex
Hayward, Chas.... Dartmouth Grange, Dartmouth
Hayward, Frederick... Needham Market
Hayward, J. Curtis... Quedgeley House, Gloucester
Haywood, Henry... Blakemere House, Hereford
Hazlerigg, Sir A. Grey, Bt.... Noseley Hall, Leicester
Head, William Alston... East Grinstead
Headlam, Morley... Whorlton, Darlington
†Heale, H. Newton... Highfield, Hemel Hempstead
Healey, Edward Charles... 163, Strand, W.C.
Heaps, Christopher... Leeds
Heard, Wm.... St. Margaret's, Ware
Heasman, Alfred... Angmering, Arundel

Heath, Douglas D....Kitlands, Dorking
Heath, R....Hefferstone, Weaversham, Northwich
†Heathcote, Capt. Eustace...Blanshard, Lyndhurst
†Heathcote, J. M....Connington Cas., Stilton, Hunts.
Heathcote, Richard...Bayterby, Atherstone
Heaton, Thomas...Alton, Cheadle, Staffordshire
Hegan, Joseph...Liverpool
Hellier, Thos. Shaw...Rodbaston Hall, Penkridge
†Hellyer, G. W. M....India
Helps, Richard...1, Barton Street, Gloucester
Helyar, Wm. Hawker...26, Manchester Sq., W.C.
Hemming, Wm....Coldicott, Moreton-in-the-Marsh
†Hempson, John A....Erwarton Hall, Ipswich
†Hemsley, John...Shelton, Newark, Notts
Henderson, John...The Shrubbery, Sandwich
Hendy, James...Trenouth, Grampound
Heneage, Geo. H. Walker...Compton Basset, Calne
†Henley, Rt. Hon. J. W., M.P....Waterperry, Oxon
Henn, T. Rice...Paradise House, Kildysart, Clare
†Henning, James...Wolveton, Dorchester
Henning, William L....Frome House, Dorchester
Henry, Frederick H....Lodge Park, Straffan, Ireland
Henry, Capt. James...Blackdown House, Petworth
Henton, Samuel...7, Bridge Street, Lambeth, S.
Hepburn Thomas...Clapham Common, S.
Hepworth, Joshua...Rogerthorp, Pontefract
†Herbert, John Maurice...Rocklands, Ross
Hercy, John...Cruchfield House, Maidenhead
Herrick, Wm. Perry...Beau Manor Park, Loughboro'
†Herries, Lord...Everingham Park, Pocklington
Hersee, Dennett...Wepham, Chichester
†Hertefeld, The Baron de...Liebenberg, Berlin
†Heseltine, E....Blackheath Park, Kent
Heslop, Rev. Gordon...Cossal, Nottingham
†Hester, G. P....Town Clerk's Office, Oxford
Hetherington, Robt....Manor Ho., Ropley, Alresford
Hewer, John E., jun....Vern House, Hereford
Hewer, William...Hill Farm, Northleach
Hewer, Wm....Sevenhampton, Highworth, Wilts
Hewitt, Jas., jun....Posbroke, Titchfield, Hants
Hews, R. S....
Hewson, John Dale, M.D....Coton Hill, Stafford
Hext, Thomas...Trerarren, St. Austell
†Heytesbury, Lord...Heytesbury, Wilts
†Heywood, Sir Benj., Bt....Claremont, Manchester
†Heywood, J....26, Palace Gardens, Kensington, W.
Heywood, Wm. H....Dunham Massey, Altrincham
†Hibbert, John...Braywick Lodge, Maidenhead
†Hibbert, Washington...Bilton Grange, Rugby
Hickin, John...Bourton, Rugby
†Hicks, Francis...Halstead
Hicks, Leonard...Paddock Lodge, Kentish Town
†Hicks, Thomas...Halstead
Hickman, Capt. W. T....Woodlands, Welling, Kent
Hickson, Richard...Hougham, Grantham
Higginbotham, Samuel...Killermont, Glasgow
Higgins, H....Woolaston Grange, Lydney, Gloucest.
Higgins, Thos....Lower Binton, Stratford-on-Avon
Higgins, Lt.-Col. Wm. B. Cole...Pict's Hill, Bedford
†Higginson, Edmund...Saltmarsh, Bromyard
Hilder, John...Sandhurst, Kent
Hilder, William...Tenterden
Hill, Lord Edwin...Norwood Park, Southwell, Notts
Hill, Charles...25, Hyde Park Square, W.
Hill, Hon. T. H. Noel...Berrington, Shrewsbury
Hill, Col. C. J....Cotgrave Place, Nottingham
Hill, Rev. J....The Citadel, Hawkstone, Shrewsbury
Hill, Richard...Golding Hall, Condover, Shrewsbury
Hilliard, Geo. Bridge...Springfield, Chelmsford
Hilliard, William Edw....Cowley House, Uxbridge
Hilton, George...South Hanningfield, Chelmsford
Hilton, Henry...Sole St. Ho., Selling, Faversham
Hilton, Stephen Musgrave...Brambling, Wingham
Hilton, Capt. Thos....Nackington Ho., Canterbury
Hincks, T. C....Brackenboro', Thirsk
†Hinde, J. H....Acton House, Felton, Northumb.
†Hippisley, John...Lamborne Place, Hungerford
†Hipwell, G. M....Cheam, Surrey
Hitch, Saml., M.D....Sandywell Park, Cheltenham
Hitchcock, H....Chitterne All Saints, Heytesbury
Hitchin, Thomas...Wardle Tile Works, Tarporley
Hitchings, Frederick...Havant, Hants
Hitchman, John, M.D....Mickleover, Derby
Hobbs, Charles...Maisey Hampton, Cricklade
Hobbs, William...Derward's Hall, Bocking, Essex
Hobson, J....Kilkea, Castle Dermot, Kildare
Hobson, John George...Long Sutton
Hockenhall, John...Royals Wood, Aston, Nantwich
Hocking, John...Bude, Cornwall
Hodding, Matthias Thos....Craven Hill Gardens, W.
Hodge, Henry...St. Levan, Penzance
Hodgkinson, Enoch...Morton Grange, Retford
Hodgkinson, Grosvenor, M.P....Withorpe, Newark
Hodgkinson, Richard...Osberton Grange, Worksop
Hodgson, E. G....Charsfield Hall, Wickam Market
Hodgson, Isaac Scott...Sodylt Hall, Ruabon
Hodgson, Richard...Chingford
†Hodgson, William...Gilston Park, Herts
Hodgson, William...Grimston, Tadcaster
†Hoffschlaeger, J. F....Weisin de Mecklenburg
Hogge, William...Thornham Hall, Lynn
Hoggins, Thomas...Trafford Lodge, Chester
†Holbech, Rev. Chas. Wm....Farnborough, Banbury
Holben, R. Rowley...Barton, Cambridge
Holborow, Daniel...Knockdown, Tetbury
Holcombe, Rev. G. F....Sherwood Lodge, Nottingham
Holding, Henry...Fardington, Alton
Hole, Henry E....Merton, Thetford
Hole, James...Knowle, Dunster, Somersetshire
Hole, James...Muskham, Woodhouse, Newark
Hole, William...Hannaford, Barnstaple
†Holland, Dr. Chas....St. Chad's, Lichfield
Holland, C....Madeley Pk. Farm, Newcastle, Staffs.
Holland, S., jun....Plas y Penrhyn, Port Madoc, Carn.
Holland, William...Streethay, Lichfield
Holliday, James...Lord Street, Liverpool
Hollings, John Albert...How Caple, Ross
†Hollins, J. C....Snitterfield, Straford-on-Avon
†Hollist, Hasler...Lodsworth, Petworth
Holloway, Horatio...Marchwood, Southampton
Holloway, Thos....Tittenhurst Lodge, Sunninghill
†Holloweg, M. de B....Runorva, Nakel, Prussia
Holmes, George...Brooke Lodge, Norwich
†Holmes, Gervas...Brockdish Hall, Scole
Holmes, Rev. John...Brooke Hall, Norwich
Holmes, J....Prospect Place, Globe Lane, Norwich

Holroyd, Fred....Knowles Fixby, Huddersfield
Holton, George...Wiston Grove, Colchester
Home, James R....Church Stretton, Salop
Home, Thomas, jun....Moreton-in-the-Marsh
Homer, John G....Martinstown, Dorchester
Homfrey, Samuel...Glen Uske, Caerleon, Newport
†Hony, Rev. P. F....25, Old Bond Street, W.
Honywood, William...
†Hood, Sir Alex. A., Bt....Bicknoller, Taunton
Hooker, John...Oatlands Park, Walton-on-Thames
Hooper, Geo...Cottington Court, Deal
†Hope, Joseph...Whoof House, Carlisle
Hope, Edwardes Thos. Hen....Moore Park, Ludlow
Hope, Sam. Pierce...Bettley Hall, Newcastle, Staff.
†Hopkins, Henry...Burnside, Van Diemen's Land
Hopkins, John...Tidmarsh House, Reading
Hopkinson, John...Manton, Worksop
Hopper, W. Cuthbert...West Hill, Wandsworth, S.W.
Hopton, Rev. John...Canon-Frome Court, Ledbury
Hopton, Rev. Wm. P....Bishop's Frome, Bromyard
†Horley, Thomas, jun....The Fosse, Leamington
†Hornby, Rev. Robt....Lythwood Hall, Shrewsbury
Hornby, Rev. W....St. Michael's Vicarage, Garstang
Hornby, W. H., M.P...Shrewbridge Hall, Nantwich
Hornby, Capt. W., R.N....Knowsley Cott., Prescott
Horncastle, J., jun....Edwinstowe, Ollerton
†Horner, James B....Lincoln
Horner, Rev. John...Mells Park, Frome, Somerset
Horner, Wm., Hamel's Farm, Puckeridge, Ware
Horniblow, William T....Ripple, Tewkesbury
Hornsby, Richard...Spittle Gate, Grantham
Hornsby, Richard, jun...Spittle Gate, Grantham
†Hornyold, J. V...Blackmore Park, Upton-on-Severn
Horton, George...Harley, Much Wenlop, Salop
Horton, Richard...Audley End, Saffron Walden
Horton, Thomas...Harnage Grange, Cresage, Salop
†Horton, Wm. Thomas...Emlesay Kirk, Skipton
Horsfall, Thomas Berry...Bellamour Hall, Rugeley
Horwood, Matthew...27, Leadenhall Street, E.C.
†Hoskins, Thos....Haselbury, Crewkerne, Somerset.
†Hoskins, William....North Perrott, Crewkerne
†Houblon, J. A....Hallingbury Pl., Bishop's Stortfd.
†Houblon, Richard Archer...Coopersale, Epping
Houghton, Thomas...Homshill Manor, Nottingham
Howard, Hon. C. W. G., M.P....Brampton
†Howard, Charles...Biddenham, Bedford
†Howard, Henry...Greystoke Castle, Penrith
†Howard, Hon. James...Hazelby, Newbury
†Howard, James...Bedford
Howard, Robert...Broughton Hall, Wrexham
Howard, Wm....Windsor Terrace, Taunton
Howden, Alexander...Murston Court, Pembridge
Howe, Earl...Gopsall, Atherstone
†Howell, Henry...Coates, Cirencester
Howell, John...Ewen, Cirencester
Howes, E., M.P....Morningthorpe, Long Stratton
Howes, P....Hamilton Ter., St. John's Wood, N.W.
Howlett, John...Bowthorpe Hall, Norwich
Howse, Nathaniel...Witney
†Hubback, Joseph...Liverpool
†Hubbard, Wm. Egerton...St. Leonard's, Horsham
Hubbersty, Rev. N...Eastwell Hall, Melton Mowbray
Hubie, Robert...Barlby Grove, Selby
Hudson, John...Castleacre Lodge, Brandon
†Hudson, T. Moore...Castleacre, Brandon
Hudson, Thos....Adderley, Market Drayton
Huggup, James...West Sleekburn, Morpeth
Hughes, Alfred...Thorness, W. Cowes, Isle of Wight
†Hughes, H.R...Kinmel Pk., St. Asaph's, Denbighs.
†Hughes, Hugh...Woodgate, Danehill, Uckfield
Hughes, Hugh Robt....Ystrad, Denbigh
Hughes, Samuel...14, Park St., Westminster, S.W.
Hulme, J. H...Cliff House, Curbar, Calver, Derbysh.
†Hulme, W....Pembroke Bank, Pembroke, S. Wales
†Hulse, Charles...Hall Grove, Bagshot
†Humberston, P. S., M.P....Mollington, Chester
Humble, William Turner...Sealand, Chester
Humfry, Wm....Oak Ash, Chaddleworth, Wantage
Humphreys, Henry...Woodhouse, Loughboro'
Humphries, E....Pershore
Humphries, John...Hampden, Andoversford
Humpidge, Thos...Great Woodcote Farm, Carshalton
†Hunt, G....Frenchwood, Preston, Lancashire
Hunt, John...Shirley, Southampton
†Hunt, John...Rainham, Rougham, Norfolk
Hunt, Thomas...Thornington, Coldstream
Hunt, William...Leicester
Hunt, William...Deeping St. Nicholas, Spalding
Hunter, Lt.-Col. Charles...Mount Severn, Llanidloes
Hunter, Hen. Launoy...Beech Hill, Reading
Hunstman, Benjamin...West Retford, Notts
Hurle, Joseph Cooke...Brislington, Bath
Hurlston, Wm....Heathcote, Wasperton, Warwicksh.
Hurrell, William...Newton, Cambridge,
Hurt, Francis...Alderwasley, Belper
†Huskinson, Thos....Epperstone, Southwell, Notts
Hussey, Edward...Scotney Castle, Lamberhurst
Hussey, Phineas Fowke...Wyrley Grove, Walsall
†Hussey, Rich. Hussey...Upwood, Huntingdon
Hussey, T....Stud Farm, Skirmett, Henley on-Tha.
Hutchings, Rev. R. S....Monkton Wyld, Charmouth
Hutchinson, Hon. Col. H. K...Weston Ho., Towcester
Hutchinson, John...Appleton Lodge, Warrington
†Hutchison, John...Monyruy, Peterhead, N. B.
†Hutchison, Robert...Carlowrie, Kirkliston, N.B.
Hutley, Jonathan...Rivenhall Hall, Witham
Hutt, John...Water Eaton, Oxford
Hutton, Thomas...Upton Gray, Odiham
Hutton, Timothy...Clifton Castle, Bedale
Hutton, William...Gate Burton, Gainsborough
Huxtable, Ven. Archd...Sutton Waldron, Blandford
†Huyshe, Rev. J....Clysthydon Rectory, Collumpton
Hyde, Francis Colville...Lyndale, Feversham
Hyett, John Edw....Haydon's Elm, Cheltenham
Hyett, W. H....Painswick, Gloucestershire

I.

Ide, John...West Wittering, Chichester
Ilbert, W. Roope...Hoswell Ho., Kingsbridge, Devon
Iles, Daniel...Fairford Retreat, Fairford
†Iles, Francis...Barnoldby-le-Beck, Grimsby
Iles, John...Binbrook Hill, Market Rasen
Impey, William...Broomfie d Hall, Chesterfield
Inge, Chas. Henry...Whittington Hurst, Lichfield

Inge, Col. Wm....Thorpe, Tamworth
Ingham, Robert...Westor, South Shields
Ingram, Hugh...Steyning, Hurstpierpoint
Ingram, Hugo F. M....Hoarcross, Rugeley, Staffords.
†Ingram, John A...Wylye, Heytesbury
†Ingram, Joseph...Wigan
Ingram, William...Armley, Leeds
Insole, James Harvey...Ely Court, Llandaff
†Ireland, J. Ireland Clayfield...Brislington, Bristol
Ireland, John Smith...Forthampton, Tewkesbury
Isaacson, John...Clare, Suffolk
Isaacson, Wm. Parr...Newmarket
Isham, Sir C. E., Bart...Lamport Hall, Northampton
Isham, Rev. R....Lamport Rectory, Northampton
Isherwood, Arthur B....Marple Hall, Stockport
Ive, Edward P....Langley, Slough
Ive, John G....The Trenches, Langley, Slough
Ives, Capt. Ferdinand..St. Catherine's Hill, Norwich
Izon, John B....Walsgrave-on-Sowe, Coventry

J.

Jackson, Matthew...Bilsthorpe, Newark, Notts
Jackson, Daniel...Chadwell Place, Grays, Essex
Jackson, P. R...Blackbrook, Gresmont, Hereford
Jackson, J....Aynscomb House, Orpington, Kent
Jackson, Richard...Noctorum, Birkenhead
Jackson, Thomas...Eltham Park, Kent
†Jackson, William...Oak Bank, Carlisle
Jackson, Wm. Kay...Barbot Hall, Rotherham
Jacson, Chas. Roger...Barton, Preston, Lancashire
Jaggard, Joseph...Leek Wooton, Warwick
James, Edward...Holeyn Hall, Newcastle-on-Tyne
James, Isaac...Tivoli, Cheltenham
James, Jas....North Sodston, Narberth, Pembroksh.
James, James William...Mappowder, Blandford
James, J. A...Bridge Town Farm, Stratford-on-Avon
James, Richard...High Street, Haverfordwest
James, Richard...Llanrwst
James, T....Otterburn Tower, Newcastle-on-Tyne
James, Sir Walter C., Bt....Betteshanger, Sandwich
†James, Capt. Wm. E....Barrack Lodge, Carlisle
†Jaques, Leonard..Easby Abbey, Richmond, Yorks.
Jaques, R. M....Easby Abbey, Richmond, Yorks.
†Jarrett, John...Camerton House, Bath
Jarvis, Sir Raymond, Bt....Cove Cottage, Ventnor
Jarvis, T. A....Higher Bolberry, Kingsbridge, Devon
†Jay, John...46, West Seventeenth St., New York
Jecks, Charles...Thorpe, Norwich
Jefferson, Henry...Rothersyke, Whitehaven
Jefferson, Rev. J. Dunnington..Thicket Priory, York
†Jefferson, Robert...Preston Hows, Whitehaven
Jefferys, N. N...Hollybrook Ho., Shirley, Southamp.
Jeggo, Thos. B....Mounts, Great Saling, Braintree
†Jegon, Trew...Slough
Jekyll, J....Carholme Terrace, Newland, Lincoln
†Jenkins, John B....Kingstone House, Abingdon
Jenkins, Richard David...The Priory, Cardigan
†Jenkinson, Sir George, Bt....Eastwood, Berkeley
†Jenner, George...Parsonage House, Udimore, Rye
Jenner, Montague Herbert...Chiselhurst, Kent
Jennings, Richard...Carmarthen
Jervis, Hon. E. Swinfen...Aston Park, Staffordsh.
†Jervoise, F. E. J....Herriard Park, Basingstoke
Jesse, Henry...Basingstoke
Jessop, Joseph...Grove Farm, Chiswick
†Jobez, Charles...17, Boulevard Madeleine, Paris
Jobling, Edward...Hill Top Cottage, Carlisle
†Jodrell, Sir Edw. R., Bt....64, Portland Place, W.
Johnson, A. H....Manor House, Acton, Middlesex
Johnson, A. H., jun....Hanger Hill Farm, Ealing
Johnson, Charles W....155, Fenchurch Street, E.C.
Johnson, Cuthbert Wm....Waldronhurst, Croydon
Johnson, C. W...Manor Cot., Larkhall Rise, Clapham
Johnson, Edward...The Deanery, Chester-le-Street
Johnson, E. W....Chichester
Johnson, Francis Dixon...Apleyheads, Durham
†Johnson, George...Blaco Hill, Retford, Notts
†Johnson, Rev. H. L....Binderton Ho., Chichester
Johnson, Rev. P....Wimborthy, Chumleigh, Devon
†Johnson, R.W...Bricklehampton Hall, Pershore
Johnson, T. C....Chevet, Wakefield
Johnson, Thomas...Halton Grange, Runcorn
Johnson, Thomas...The Hermitage, Frodsham
†Johnson, Thomas...Whittlesea, Cambridgeshire
Johnson, Walter...Trench Hall, Gateshead
Johnson, Walter F....Leicester
Johnston, J. Lindsay...Crondall, Farnham, Surrey
Johnstone, Edward...3, King's Bench Walk, Temple
†Johnstone, Rev. George...Broughton, Hunts
†Johnstone, J. C. H....Hardwick Hall, Durham
Joicey, John...Urpeth Lodge, Fence Houses
Jollands, William D....Buxshalls, Lindfield, Sussex
†Jolliffe, Sir W. G. H., Bt., M.P...Heath Ho., Petersfield
Jonas, John Carter...3, St. Mary Street, Cambridge
Jonas, Samuel...Chrishall Grange, Saffron Walden
†Jones, David, M.P....Pantglas, Carmarthen
Jones, Edward...6, York Crescent, Clifton, Bristol
Jones, George...Stareton, Kenilworth
Jones, George...Whiston Lodge, Penkridge
Jones, Harvey Bowen...49, Montagu Square, W.
Jones, H. P....Portway House, Warminster
†Jones, James Cove...Loxley, Warwick
†Jones, John...Blaeno's, Llandovery, S.W.
Jones, John...West Keal Hall, Spilsby
Jones, John...Bryn Adda, Dolgelly
†Jones, J. E....Springfield, Braunton, Hereford
Jones, J. O....Dollycorsllwyn, Cemmes, Shrewsbury
Jones, R. Hesketh...North Brook House, Dover
Jones, R. P....The Hermitage, Whitchurch, Salop
†Jones, Sir W., Bt....Cranmer Hall, Fakenham
†Jones, Wm....Harrington, Shiffnal
Jones, W. Hope...Hooton Farm, Sutton, Cheshire
†Jones, W. B....Kilgariff, Clonakilty, Ireland
Jordan, Francis...Eastburn, Driffield
Jordan, Wm....Charlton Kings, Cheltenham
Josling Geo. F....Berners Roding Hall, Dunmow
Jowett, Rev. J. F....Kingston, Bagpuze, Abingdon
Jowitt, Christopher...Palterton, Chesterfield
Joyce, Thomas...Vale Farm, Sudbury, Harrow
†Justice, Henry...Hinstock, Market Drayton

K.

†Karslake, Rev. W. H.....Mesham, Southmolton
†Kay, J. R....Bass Lane House, Bury, Lancashire

Kay, R....Forcett Valley, Darlington
Kearsey, Charles...Glewstone, Ross
Keary, H. W....Longlands, Holkham, Norfolk
Keeling, Charles...Congreve, Penkridge
Keeling, Chas. R....Yew Tree Farm, Penkridge
†Keene, Rev. C. E. R....Swincombe Ho., Nettlebed
Keep, Richard...Aldermaston, Reading
Kekewich, S. Trehawke, M.P....Peamore, Exeter
Kelham, Robert Kelham...Bleasby, Southwell
Kell, William...Gateshead
†Kelsall, H., jun....Ravenswood, Melrose, Roxbur.
†Kemble, Horatio...Potter's Bar, Barnet, Herts
†Kemble, Thomas...Legatts, Hatfield, Herts
Kendrich, Edward...Wreford, Lichfield
†Kennaway, Sir John, Bart....Escot, Honiton
Kennedy, David...Oriental Club, W.
Kennedy, Rt. Hon. T. F....Dalquharran Castle, N.B.
Kennedy, Primrose W....Drumellan, Ayr
Kenrich, George...Thurgarton Hill, Southwell
†Kensington, Edward Thomas..Moolham, Ilminster
Kent, John...Mortimer, Reading
†Kenyon, Hon. E....Macefen, Whitchurch, Salop
†Kerrich, John...Geldeston Hall, Beccles
Kerry, the Knt. of (P. Fitzgerald)...Kerry
Kersey, Clement....Whitton, Ipswich
Kersey, James...Farlton Farm, Cirencester
†Kesterton, Thomas...Sutton, Surrey
Kett, George Samuel...Brook House, Norwich
†Kettle, Geo. Mackenzie...Dallicott Ho., Bridgenorth
Key, Sir Kingsmill Grove, Bt....95, Newgate St., E.C.
Keyes, Hen. James...Ashingdon, Rochford, Essex
†Keyworth, Henry Joseph...Cottesford Pl., Lincoln
†Keyworth, J. R. Haldenby..Greestone Ho., Lincol.
Kibble, Thomas...Green Trees, Tunbridge
Kiddle, F. G....Moreton, Dorchester
Killick, Arthur...Deepdene Park Farm, Dorking
Kindersley, E. Leigh...Syward Lodge, Dorchester
King, C....North Lodge Farm, Potter's Bar, Barnet
King, Charles Allen...98, Piccadilly, W.
King, George...Saffron Walden
King, John K., M.P...Staunton Park, Leominster
King, John G....Beedon, Newbury
King, John L....Thorp Abbots, Scole Inn, Norfolk
King, Rev. J. Meyers...Cutcombe Vicarage, Dunster
King, Hon. J. P. L., M.P....Woburn Pk., Chertsey
King, Richard King Meade...Walford, Taunton
King, R. Meade...Pyrland Hall, Taunton
King, Stephen...Old Hayward, Hungerford
King, William...Barton, Bury St. Edmund's
King, W. C....Warfield Hall, Bracknell
Kingdon, Rev. S. N....Bridgerule Vicar., Holsworthy
Kingdon, Samuel...Layrick, Thorverton
Kingsby, Thomas...Boarscroft, Tring
†Kingscote, Col. R. N. F.. M.P...Kingscote, Glouc.
Kingsford, John...Esher, Surrey
†Kingsmill, Wm....Sydmonton Park, Newbury
Kinloch, Colonel...Logie, Kirriemuir, N.B.
Kinnaird, Lord...Rossie Priory, Inchture, Perthshire
†Kirk, R....Gale Bank, Leybourne, Wensleydale
Kirkaldy, Rt. Hon. Viscount...Windsor
Kirkby, Thomas...Cuxwold, Caistor
Kirkham, Thomas...Biscathorpe House, Louth
Kirkland, Sir John, Bt....17, Whitehall Place, S.W.
Kirkpatrick, Capt. John ...Monk's Horton, Hythe
Kirwan, J. Stratford..Moyne, Ballyglunin, co. Galway
Kitson, James...Leeds
Kitson, William...Torquay
Knapping, Dale...Sutton, S. Shoebury, Ingateson
Knatchbull, Rev. W...Cholderton Lodge, Amesbury
†Knatchbull, Wm....Babington, Frome, Somersets.
†Knight, A. J. R. B...Downton Castle, Leintwardine
Knight, Edward...Chawton House, Alton
†Knight, E....High Leadon, Newent, Gloucestersh.
Knight, John...Wideness, Warrington
Knight, John...Forthampton, Tewkesbury
Knight, R. Farthing...Hereford
Knight, Thomas...Norlington, Lewes
Knight, Thos. Henry...Stoke Canon Vicarage, Devon
Knightley, Sir C., Bt., M.P...Fawsley Pk., Daventry
†Knighton, Sir W., Bt...Blendworth Ldg., Horndean
Knollys, J. E....Fitzhead Court, Taunton
Knollys, Gen....Blount's Court, Henley, Oxon
Knowles, James...Wetherby
Knox, Octavius Newry...South Collingham, Newark
Kynnersley, J. C. S....Handsworth, Birmingham
Kyrke, Rich. V....Stansby Lodge, Wrexham

L.

Lacey, Wm. Charles...Bestwell House, Wareham
Lake, James...Newlands, Teynham, Sittingbourne
Lake, Robert...Milton, Canterbury
Lakeman, John...Costislost, Bodmin
Lakin, Henry...Link End, Malvern
†Lamb, William...Hay Carr, Ellel, Lancaster
Lambe, John...Church Bank, Bowdon, Manchester
†Lambert, Chas....Sunk Island, Otteringham, Hull
†Lambert, Henry T....74, Grosvenor Street, W.
Lambert, Rob. de..Common Head, Staveley, Kendal
Lambert, Wm. Chas....Misterton, Crewkerne
†Lamothe, Frederick J. D....Ramsey, Isle of Man
Lander, Thomas Eaton...The Innage, Shiffnall
†Landor, H. Eyres...Warwick
Lane, John...Barton Mills, Cirencester
Lane, John...Broom Court, Alcester
Lane, John...Wenlock Brewery, City Road, E.C.
†Lane, William...Broadfield, Northleach
Langdale, Hon. C...Houghton Hall, Market Weighton
Langdale, Wm. Atkinson...Holmwood Pk., Dorking
Langdon, William...Ashford House, Barnstaple
Langham, Herbert...Cottesbrooke, Northampton
Langlands, John Charles...Bewick, Alnwick
†Langton, W. H. P. Gore...Newton Park, Bath
†Lascelles, Hon. G. E...Moor Hill, Harewood, Leeds
La Touche, Col. David...Marlay, Dublin
Latham, Geo. William...Bradwall Hall, Sandbach
Lauwarne, Nicholas...St. John's Street, Hereford
Lauder, Joseph...Burton, Christchurch
Laverach, Samuel S....Redness Hall, Goole
†Law, Rev. R. V....Christian Malford, Chippenham
Lawes, J. Bennet..Rothamsted Park, St. Albans
Lawford, Edward...Linslade, Leighton Buzzard
†Lawford, Thomas, jun....London, Canada West
†Lawley, Hon. & Rev. S. W...Escrick Rectory, York
Lawrence, Charles...Cirencester
Lawrence, Herbert...Little Dilwyn, Leominster
Lawrence, J....Great House, Churchdown, Gloucest.

Lawrence, Thomas...Churchdown, Gloucester
†Lawrie, Andrew...Mount Mascal, North Cray
†Lawson, C...George the Fourth Bridge, Edinburgh
†Lawson, Chas., jun...34, George Square, Edinburgh
Lawson, E...Redesdale Cottage, Newcastle-on-Tyne
Lawson, Rev. Edw....Longhirst Hall, Morpeth
Lawson, Wilfrid, M.P....Brayton, Carlisle
Lawson, Sir Wm., Bart....Brough Hall, Catterick
Lawson, William...Brayton Hall, Carlisle
Lay, Rev. John Ward...Hele, Ashburton
†Lay, John W...3, Savage Gardens, Tower Hill, E.C.
Laycock, Joseph...Seghil House, Northumberland
Layton, R. Marton...Thorney Abbey, Peterborough
Lea, Joseph...Grove Mount, Davenham
Lea, Thomas...Brown Edge, Brereton, Congleton
Leach, Henry...Corston, Pembroke
Leach, John...Ivy Tower, Tenby
Leader, Nicholas...Dromagh, Bonteen, Ireland
Leather, George...Knostrop, Leeds
Leather, Simeon...Delamere, Northwick
†Leaver, Francis...Longnor Hall, Penkridge
†Lechmere, Sir E. A. H., Bt....Upton-on-Severn
Le Cornu, Charles Philip...Beaumont, Jersey
Ledger, Reuben..Grove House, W. Derby, Liverpool
Lee, Charles...Grantley Hall, Ripon
Lee, Edward...Stocksfield Hall, Newcastle-on-Tyne
Lee, Capt. John...Woolley Firs, Maidenhead
Lee, Joseph...Dilston, Hexham
Lee, Joseph Henry...Redbrook, Whitchurch, Salop
Lee, Daniel Jas....4, Bedford Row, Gray's Inn, W.C.
†Lee, J. Lee...Dillington House, Ilminster
Lee, Thomas...Great Barr, Birmingham
†Lee, Vaughan Hanning...Pudlicote, Charlbury, Oxf.
Leech, John...Wall Hill, Leek
Leedham, William...Andover
Leeds, Henry...Stibbington, Wansford, Northampt.
†Leeds, Robt....Lexham, Castleacre, Brandon
Leeke, R....Longford Hall, Newport, Shropshire
Lees, John...Reigate
Lees, William...Blacon Hall, Chester
Leese, Benjamin...Eastling, Faversham
Le Gallais, Albert...La Moire House, Jersey
Legard, George...Easthorpe Hall, Malton
Legard, Capt. James A....Cowes
Legerton, John Stock...Shalford, Braintree
Legg, Thomas...Burton Bradstock, Bridport
Leggatt, H. B....Brownwich, Fareham
Leggatt, S. B....Crofton, Titchfield
Legge, Benj....Court Ho., Litton Cheney, Dorchester
Legh, G. Cornwall, M.P....High Leigh, Warrington
Leigh, F. A...Rosegarland, Foulksmill, co. Wexford
Leigh, John Gerard...The Hoo, Luton
Leigh, John Shaw...The Hoo, Luton
Leigh, W., jun....Woodchester Park, Gloucestershire
Leighton, Sir Baldwin, Bt., M.P....Loton, Shrewsb.
Leir, Rev. W. M....Ditcheat Rectory, Castle Cary
†Leith, Sir A...Glenkindie, Iverkindie, Aberdeen
†Lempriere, Capt. G. O....Pelham Place, Alton
Lempriere, William...Royal Manor, Jersey
Lennard, Col. J. F....Wickham Court, Bromley
†Lennard, Sir T. B....Belhus Ho., Avely, Romford
Leonard, Charles...Castle Camps, Linton, Cambs.
Leonard, Rev. F. B....Brook Ho., Newport, Monm.
Leslie, Charles Powell...Glasslough, Ireland
Lethbridge, Ambrose Goddard...Bank, Taunton
Lewes, Col. John...Llanliar, Talsarn, Carmarthen
Lewes, Rev. Thomas...Taynton, Burford, Oxon
Lewis, David...Stradey, Llanelly, Carmarthen
Lewis, G....Audley, Newcastle-under-Lyne
Lewis, Edward...Pickhill Hall Farm, Wrexham
Lewis, I. H....Gallants Ct., East Farleigh, Maidstone
Lewis, J. L. G. R....Henllan, Narberth, Pembroke
Lewis, S....Audley, Newcastle-under-Lyne
Lewis, Thomas...Norchard, Tenby
Lewis, T. F....Newport, Monmouthshire
Lewis, W. H....Clynfiew, Newcastle Emlyn
Lewis, Wyndham W....Llanishew House, Cardiff
Ley, John Henry...Trehill, Exeter
Leyshon, Robert...Island Farm, Bridgend
Lichfield, Coventry H...Nuffield, Henley-on-Tham.
Lichfield, Earl of...Shugborough, Staffordshire
Lightfoot, William...Barrow, Chester
Lilley, James...Bassingbourn, Royston
Linaker, P....Norton Hill, Preston Brook, Cheshire
Lindley, Urban...Radmanthwaite House, Mansfield
Lindsay, Hugh H....West Dean House, Chichester
Lindsell, Lieut.-Col...Fairfield House, Biggleswade
Linley, William...Sutton, S.
†Linton, Rev. J....Hemingford Ho., St. Ives, Hunts
Linton, John...Westwick House, Cambridge
Lintott, Wm....Holmbush, Slinfold, Horsham
Linzee, Robert G....Jermyns, Romsey
Litchfield, John...Epperstone, Nottingham
Little, Edward...Lanhill, Chippenham
Little, Hack Magnus...Elmington, Oundle
Little, Wm. H....Llanvair Grange, Abergavenny
Littledale, Harold...Liscard, Liverpool
Littledale, Henry...Cardington, Bedford
Livesey, Rev. Thos....Stourton Hall, Horncastle
†Llewellin, R...Tregwynt, Fishguard, Pembrokesh.
Llewellyn, Wm....Courtcolman, Bridgend, S.W.
Llewelyn, J. D...Pullengare, Swansea
†Lloyd, Arthur P....Abbot's Leigh, Bristol
Lloyd, Edw. Harvey...Aston Hall, Oswestry
Lloyd, J. A....Leaton Knolls, Shrewsbury
Lloyd, John...Belsize, Hampstead
Lloyd, Llewellyn F....Nannerch Hall, Mold
Lloyd, Rev. Thos....Rectory, Christleton, Chester
Lloyd, William Butler...Monkmoor, Shrewsbury
Loader, J....Firgrove Farm, Whitchurch, Hants
†Lobb, Geo., jun....Lawhitton, Launceston, Cornwall
Lock, George...Instow Barton, Barnstaple
†Locker, Wm. J....Tillington House, Stafford
Lockwood, Joshua...Hawley House, Farnborough
†Locock, Sir C., Bt....Tunbridge Wells
†Locock, Edmund...South Elkington, Louth
†Locock, Fred....26, Hertford Street, May Fair, W.
Logan, J...Maindee House, Newport, Monmouthsh.
Long, Alexander Wearing.. Mint Cottage, Kendal
Long, Daniel...Waddon, Gloucester
Long, H. Laws...Hampton Lodge, Farnham, Surrey
†Long, Kellett...Dunstan Hall, Norwich
†Long, Rich. P....Dolforgon, Newtown, Montgom.
Long, Walter...Preshaw House, Bishop's Waltham
Long, W. Jervis...Preshaw Ho., Bishop's Waltham
†Longbourne, W. T....4, South Square, Gray's Inn

†Longcroft, C. J....Havant
Longcroft, C. R....Llanina, Abereyron, Cardigansh.
†Longe, John...Spixworth Park, Norwich
†Longford, Earl of...Packenham Hall, Westmeath
†Loomes, Edward...Whittlesea, Cambridgeshire
†Lopes, Sir Massey, Bart....Maristow, Plymouth
Loraine, Edward...The Riding, Newcastle-on-Tyne
†Lord, John...Elmley Park, Pershore
†Louch F. Wm. B....
†Lovaine, Lord...Albury Park, Guildford
Love, Peter...Northampton
Love, Samuel...Castle Farm, Shoreham, Sevenoaks
Loveday, John...Williamscote, Banbury
†Lovell, Edward W. L....The Meads, Eastbourne
†Lovell, Edwin...Dinder, Wells, Somerset
†Lovell, Thomas...Winwick Warren, Rugby
Lovett, Joseph Venables...Belmont, Chirk
Lowe, Edward...Comberford Mill, Tamworth
Lowe, John...Ryhall, Stamford
Lowe, John...Whitmore House, Birmingham
Lowe, John...Bridge Farm, Handley, Chester
Lowe, John...Wheelock Heath, Sandbach
Lowe, Joseph...Stackton Hall, Malpas
Lowe, Peter...Marston, Stafford
Lowe, Thomas...Calverley Hall, Handley, Chester
†Lowndes, Geo. Alan...Barrington Hall, Harlow
†Lowndes, W. L....Linley Hall, Bridgnorth, Salop
Lowrey, Wm....Barmoor, Berwick-on-Tweed
†Loyd, Edw., jun....Prestwick Lodge, Manchester
†Loyd, Wm. Jones...Langleybury, Watford
†Lubbock, Sir J. Wm., Bt....Mansion House Street
Lucan, Earl of...Laleham, Staines
†Lucas, Bernard...Chesterfield
Lucas, George...Filby House, Great Yarmouth
†Lucas, Lieut. Richard...Edith Weston, Stamford
Luckham, Levi...Broadway, Weymouth
Lucy, Rev. J....Hampton Lucy, Stratford-on-Avon
Ludolf, Henry...Headingley Lane, Leeds
Ludlow, H. G. G....Heywood House, Westbury
Luff, John W....Canford, Wimborne
†Lugar, Henry...Hengrave, Bury St. Edmund's
Lund, Capt. Thos....Lovely Hall, Blackburn
Lungley, Brooke M...Peyton Hall, Boxford, Suffolk
†Lupton, Arthur...Newton Hall, Leeds
Lurgan, Lord...Brownlow Ho., Lurgan, Armagh
†Lushington, C. Manners...
Lutener, Thomas...Keele, Newcastle, Staffordshire
Lutteroth, Robert...Hamburgh
Luttrell, Rev. Alex. H. F....Minehead, Taunton
†Lyall, William...Balmakervian, Montrose, N.B.
Lyell, Thomas...Shiehill, Kirriemuir, N.B.
Lyne, Charles, R.N...Newport, Monmouthshire
Lyne, Wm....Oddington, Stow-on-the-Wold
†Lynes, G. Boulton...Hackleton Ho., Northampton
†Lyon, J. W....Miserdine Park, Cirencester
Lyon, Capt. T. D....
Lysley, Wm. John...Mimwood, Potter's Bar, Herts
Lyveden, Lord...Farming Woods, Thrapstone

M.

Mabbett, John...Stinchcombe, Dursley, Gloucester
Maberley, the Hon. Mrs....15, Manchester Square, W
†Macclesfield, Earl of...Sherburn Castle, Tetsworth
MacClintock, Maj. H. S...Randalstown, Antrim
MacConnell, F....Robgill Tower, Ecclefechan, N.B.
†MacDonald, Sir A. K....Woolmer Lodge, Liphook
MacDouall, Col. James...Stranraer, N.B.
†MacDougall, A. H....44, Parliament Street, S.W.
†MacDowall, J. C. S...Sydney, New South Wales
Mace, J. Ellis...Ashford Road, Tenterden, Kent
MacGregor, Duncan...Eccleston, Chester
†MacEwen, James...Clonshire, Croagh, Limerick
Machin, J. Vessey...Gateford Hall, Worksop
Mack, A....Livers Acle, Withington, Hereford
Mackay, Thos. Henry...Petham House, Canterbury
†Mackenzie, E....Fawley Court, Henley-on-Thames
Mackie, W. Hay...Yscuborissa, Oswestry
†MacIntosh, David...Havering, Romford
†MacLagan, Peter...Pumpherstone, Midcalder
Maclean, Allan, M.D....Colchester
†Macleod, Norman...
†MacNiven, Charles...Perrysfield, Oxted, Surrey
MacRae, Dr. A...5, Sheen Villas, Richmond, S.
Madam, M....Brant, Broughton, Newark-on-Trent
†Maddison, George Wilson...Partney, Spilsby
Maddox, John...Harley, Much Wenlock
†Madgwick, Wm., jun....Alciston, Lewes
†Mahon, H. J. P...Strokestown House, Roscommon
Maidens, Thomas Cousins...Brinkhill, Spilsby
†Mainwaring, C. Kiuaston...Oteley Park, Ellesmere
†Mainwaring, Townshend...Galltfaenan, Denbigh
†Maitland, Col. Fred. Thos...Babbicombe, Torquay
†Maitland, J. G....Surrey Villa, Lambeth, Surrey
Majendie, Ashhurst...Castle Hedingham, Essex
Makgill, George...Prestbury, Cheltenham
†Malcolm, Maj.-Gen. G. A...67, Sloane Street, S.W.
†Malcolm, John...7, Great Stanhope Street, W.
Malcolm, M....Manor House, Kineton, Warwicksh.
Male, Henry...East Chinnock, Yeovil
Malloch, C. H....Court House, Cockington, Torquay
Malmesbury, Earl of...Heron Court, Christchurch
†Maltby, Edward Harvey...G 3, Albany, W.
†Manchester, Duke of...Kimbolton Castle, Hunts
†Mangles, F....Down Farm, Compton, Guildford
Mangles, George...Givendale Grange, Ripon
Mangles, Ross D....Stoke, Guildford
Mann, Henry...The Asps, Warwick
Mann, John...Thornage, Thetford
Mannings, George...Downton, Salisbury
Manning, Henry...251, High Holborn, W.C.
Manning, John...Orlingbury, Wellingborough
Mansel, J. C....Whatcombe, Blandford, Dorset
Mansel, Lieut.-Col...Smedmore, Corfe Castle, Dorset
Mansel, Raleigh A...Heathfield, Swansea
†Mansell, Sir John, Bart....Maesdeilo, Llandilo
Mansell, Thomas...Adcott Hall, Baschurch, Salop
Mapplebeck, W. B....6, Bull Ring, Birmingham
†Margary, Maj. A. R....Chartham Pk., E. Grinstead
Margetson, James...Manor House, Shalden, Alton
†Margetts, Charles...Huntingdon
Margetts, John...High Street, Warwick
Marjoribanks, E...Greenlands, Henley-on-Thames
†Marjoribanks, D. C....Bushey Hall Farm, Watford
†Marjoribanks, Edward, jun....59, Strand, W.C.
†Marjoribanks, Stewart M.P...Bushy Grove, Watford

Markby, John Randall...9, Whitehall Place, S.W.
†Markham, Charles, jun....Northampton
Markham, Lt.-Col. W. T...Becca Hall, Milford Junc.
Marmont, James...Bristol
Marriott, H. C....Narborough, Brandon
Marriott, Rev. J. P....Cottesbach, Lutterworth
†Marriott, W. M....Market Harborough
Marris, Thomas...Ulceby, Lincolnshire
Marsh, Matthew H., M.P....Chilbury Ho., Salisbury
Marsh, Thomas...The Heamies, Stone, Staffordshire
Marsh, Wm. Jas....Loridge, Berkeley, Gloucestersh.
†Marshall, Arthur...Headingley, Leeds
†Marshall, Edward H....Westwood Hall, Leeds
†Marshall, Geo. H....32, St. George's Rd., Pimlico
Marshall, H. J....Poulton Priory, Cricklade
†Marshall, James Garth...Headingley, Leeds
Marshall, John...Eden Lodge, Beckenham, S.E.
Marshall, John...Riseholme Lodge, Lincoln
Marshall, T. Bumpstead...Branstone, Lincoln
Marshall, Wm....Bolney Place, Cuckfield, Sussex
Marsham, R., D.C.L....Merton College, Oxford
Marson, W....Acton Trussell, Penkridge
Marten, Peter...Chilham, Canterbury
Martin, Chas. W., M.P....Leeds Castle, Maidstone
Martin, David...Wainfleet, Lincolnshire
Martin, E. Hall, jun....Barr Hill, Madeley, Staffs.
†Martin, E. Waterer...Nonsuch Park Farm, Ewell
†Martin, Fran. P. B....Oxford and Cambridge Club
†Martin, Gilson...Thorney, Peterborough
Martin, Henry B....Colston Basset, Bingham, Notts.
Martin, John...Evershott, Dorset
Martin, Robert...Asterby, Horncastle
Martin, S. D....2, Park Place, Leeds
Martineau, R....Walsham-le-Willows, BurySt.Edm.
Mashiter, Thomas...Priest's Romford, Essex
Masfen, R. Hanbury...Pendeford, Wolverhampton
†Mason, C. A....Tarrington, Ledbury, Herefordsh.
Mason, Capt. Geo....Manor House, Yateley, Hants
Mason, Matthew...9, Portland Place, Brighton
Mason, Richard...Keddington, Louth
Mason, T....Pallinsburn Cottage, Coldstream, N.B.
Mason, Col. Wm....Necton Hall, Swaffham
Massey, Sampson...Harkstone, Derby
Massey, Samuel...Lawton Arms, Lawton, Cheshire
Massey, Capt. H. H. J....Hazlehurst, Lymington
†Master, Charles H...Barrow Green House, Godstone
Master, Col. Wm. C....Knowle Park, Bristol
Master, Col. Thos. W. C....The Abbey, Cirencester
Masterman, Thos. J....Little Danby, Northallerton
Masterson, J....Collingbourn Ducis, Marlborough
Matchett, William...Norwich
†Matheson, Sir J., Bt., M.P...The Lewes Island, N.B.
Mathew, Nath....Wern, Tremadoc, Carnarvonshire
Mathews, Augustus...Pitchcombe, Stroud
†Mathews, Jeremiah...Edgbaston Ho., Birmingham
Mathews, William...The Leasowes, Birmingham
Maton, Leonard Pitt...Maddington, Devizes
Matson, William...St. Osyth, Colchester
†Matson, W. Bawtree...Kentish Bldngs, Southwark
Matthews, Francis Cook, jun....Driffield
Matthews, Frank...Glyn Moore, Isle of Man
Matthews, Francis Cook...Driffield
Matthews, Henry...Montford, Shrewsbury
†Matthews, Thomas...Sporle, Swaffham
Maud, Chas. T....Manor House, Bathampton, Bath
Maude, Wm. E....Holmscales, Milnthorpe
Maunsell, Thomas P....Thorpe Malsor, Kettering
Maw, H. Lister...Tetley, Crowle, Isle of Axholm
Maw, Mathew...Cleatham, Kirton-in-Lindsey
Maxwell, Sir J. H., Bt....Springkell, Ecclefechan
Maxwell, Hon. M. Constable...Terregles, Dumfries
Maxwell, Wellwood...Munches, Dalbeatie, N.B.
May, Charles N....Devizes (North Wilts Foundry)
May, George Anderson...Elford Park, Lichfield
May, John...London Road, Reading
Mayall, John E...224, Regent Street, W.
Mayer, J. Smith...Newcastle, Staffordshire
Maynard, A. Lax....Marton-le-Moor, Boroughbridge
Maynard, Robert...Whittlesford, Cambridge
Mead, James...Penrhyn, Cornwall
Mead, Wm. Rich....Ballymartle, Kinsale, Cork
Mechi, Alderman J. Jos....4, Leadenhall Street, E.C.
†Medlycott, Sir W. C., Bt...Milborne Port, Sherborne
Meeson, Wm. Taylor....Doggetts, Rochford
Mein, William...Brewood, Staffordshire
Meire, Sam....Castle Hill, Harley, Much Wenlock
Meire, Thos. Lockley...Cound Arbor, Shrewsbury
Mellard, James...Rugeley, Staffordshire
Mello, William...Chadwell, Ware
Mellows, William...Carburton, Worksop
Melville, Hon. A. Leslie...Branston Hall, Lincoln
†Melville, Charles Leslie...Branston Hall, Lincoln
Melvin, James...Bonnington, Ratho, Edinburgh
†Mercer, James, M.D....
†Mercer, William...Newton, Warrington
Mercer, William...Grove Ho., Hunton, Staplehurst
†Merriman, Thomas Baverstock...Marlborough
†Merriman, Wm. Clark...Lockeridge, Marlborough
Merson, Jas....Brinsworthy, North Molton, Devon
†Mertens, Baron Edward...Rue Ducale, Brussels
†Metcalfe, C.J...13, Arundel Square, Islington, N.
†Methley, W....Hoath Court, Blean, Canterbury
Meux, Sir H., Bt...Theobald's Pk., Waltham Cross
†Meyer, Herman...Little Laver Hall, Ongar
†Meyer, James...Forty Hall, Enfield, Middlesex
†Meyer, P. Herman...Stondor Place, Brentwood
Meyrick, Owen Fuller...Bodergan, Anglesey, N.W.
Michell, John...Forcet Park, Darlington
Mickleburgh, Charles...Montgomery
†Micklethwaite, Rev. J....Iridge Pl., Hurst Green
Middleborough, J. R....South Milford, Milford Junc.
†Middleton, Henry...Cutteslowe, Oxford
Middleton, Saville...Water Newton, Hunts
†Midgley, W. H....Bryntirion, Corwen, Merioneth.
Midworth, John...Newark-on-Trent
Milbank, Sussex...Barningham Park, Yorkshire
Mildmay, Humphrey, M.P....Shoreham, Sevenoaks
†Miles, John Wm....King's Weston, Bristol
†Miles, Grosvenor...Bourton House, Rugby
†Miles, P. W. S....Leigh Court, Bristol
Miles, Roger Dutton...Keyham, Leicester
Miles, Thomas...Keyham, Leicester
†Miles, William...Dix's Field, Exeter
Miles, Wm. Marsh...Fragham, Wingham, Kent
Milford, Thos....Thorverton, Exeter
†Miller, Bartlett...Moulton, Northampton

Miller, George...Barnstaple
Miller, G. Seymour...Bradpole, Bridport
Miller, Samuel...Dysert Farm, Welshpool
Mills, John F....Westwell, Burford, Oxon
Mills, John...Bisterne, Ringwood
Mills, John...Pinkneys Green, Maidenhead
†Mills, J. R....Englefield Green, Surrey
Mills, R. W. F....Dunnington, York
†Mills, Wm....Saxham Hall, Bury St. Edmund's
Milne, David...Milne Garden, Coldstream, N.B.
Milne, Oswald, jun....Woodville, Leamington
Milner, Sir W. M. E., Bart...Manappleton, Tadcaster
Milnes, James...Alton Manor, Wirksworth, Derbys.
Milward, Dawson A....Tullogher, New Ross
Milward, Richard...Thurgatton Priory, Southwell
Minch, J. F....
Minet, Charles Wm....41, West Smithfield, E.C.
Minett, Junius E....Arley, Coventry
Minor, John...Fern Hill, Market Drayton
Minton, Alfred...Windsor
Mitchell, Andrew...Alloa, Clackmannanshire, N.B.
Mitchell, John...Wymondham, Norfolk
Mitchell, J. Hoffe...Witchampton, Wimborne
†Mitford, Wm. Townley, M.P....Pitshill, Petworth
Molyneux, James More...Losely Park, Guildford
Monck, J. Bligh...Coley Park, Reading
Monckton, E...Hale Place, East Peckham, Tunbridge
†Monckton, E. H. C...Fineshade Abbey, Northamp.
Monkhouse, Fred. Thos....Dorney Lodge, Windsor
Monkhouse, John...The Stowe, Hereford
Monins, John...Ringwould, Dover
Monro, Mordaunt Martin...Enfield
Montagu, G. H....Caversham Hill, Reading
†Monteagle, Lord...Mount Trenchard, Limerick
Montgomerie, F. M...St. Leonard's Ho., St. Leonard's
Montgomery, Rev. R...Holcott Rectory, Northampt.
Moody, Chas. Aaron, M.P....Kingsdon, Yeovil
Moody, Harry...Chartham, Canterbury
Moody, Col. R. C....Junior United Serv. Club, S.W.
†Moore, Rev. Edward...Frittenden, Staplehurst
Moore, Edward Wells...Coleshill, Faringdon
Moore, George...Appleby Hall, Atherstone
†Moore, Rev. G. Bridges...Tunstall, Sittingbourne
Moore, Henry...Elmsley Castle, Pershore
Moore, James...Monksbury Court, Ledbury
Moore, J. ..11, Upper Berkeley St., Portman Sq., W.
Moore, John...Kerry, Montgomery
Moore, John...Church Street, Warwick
Moore, John...Moor House, Badsworth, Pontefract
Moore, Joseph...Wollaton House, Nottingham
†Moore, Thos. William...Warham, Wells, Norfolk
Moore, Wm....Elm, Wisbeach
Moorsom, C. R....Darlington
Morant, George...Farnborough, Hants
Morewood, Col. W. P....Alfreton Park, Derbyshire
Morgan, Francis...51, Bedford Square, W.C.
†Morgan, Maj. G. C., M.P....Rupera Castle, Cardiff
Morgan, John...Green Lanes, Birmingham
Morgan, John...Market Square, Shrewsbury
Morgan, Thomas...Burnt House, Waltham Cross
Morison, John Alex., M.D....Portcleu, Pembroke
Morland, George Bowes...Abingdon
Morland, W. Courtenay..Court Lodge, Lamberhurst
Morley, Earl of...Saltram, Plymouth
†Morley, John...
Morley, John...Broughton Lodge, Manchester
Morley, John...Effingham Hill, Dorking
Morley, Robert...Birkbeck, Northallerton
Morley, William...Brize Norton, Faringdon
†Morrell, Frederick J....St. Giles's, Oxford
Morrell, James...Headington Hill, Oxford
Morrell, James Conyers...Leyland, Lancashire
†Morrice, J. W....The Tower, Calthorpe, Rugby
Morris, John...Wightwick House, Wolverhampton
†Morris, Col. Lewis G....Morrisania, New York
†Morris, Norman...The Warren, Edenbridge, Kent
Morris, Richard...Knockin Heath Farm, Oswestry
†Morris, Thos., jun....Walcote Fields, Lutterworth
Morris, Thomas...Maisemore, Gloucester
Morris, Walter...Dewsal Court, Hereford
Morris, William...Carmarthen
Morris, Wm. C...Whitwick, Lower Eagleton, Ledbury
Morrison, Frank...Hole Park, Tenterden
†Morrison, Walter, M.P....Malham Tarn, Skipton
Morriss, N....Blue Ho., Washington Stat., Durham
Morrow, Hugh...Coraboold House, Longford
Morshead, Sir Warwick, Bt....Forest Lodge, Binfield
Morton, John Chalmers...Streatley, Reading
†Morton, J. D....8, Gloucester Terrace, S.W.
Moscrop, W. J....Buscot Park, Faringdon
Mosley, Sir O., Bt...Rolleston Hall, Burton-on-Trent
Mosley, Touman...East Lodge, Burton-on-Trent
Moss, D. Topham...16, Camden Terrace, Leeds
Moss, Henry...Bentley Hill, Brentwood
Mostyn, Sir P., Bt....Talacre, Holywell, Flintshire
†Mott, Charles John...Lichfield
Mott, Thomas...Much Hadham, Ware
Mott, William...Wall, Lichfield, Staffordshire
Moult, Wm....Knowsley, Prescot, Lancashire
Mount Edgecumbe, Earl of...Mt. Edgecumbe, Devon
Mount, Thomas...Saltwood, Hythe
Mount, William...Wasing Place, Reading
Mourant, Edward...Samare's Manor, Jersey
Moxon, William...3, St. Martin's Place
†Moysey, H. G....Batheaton Court, Wiveliscombe
†Muggeridge, Sir Henry, Kt....Ashurst, Dorking
Mulkern, Edmund Cowell...Leighfield, Oakley
Mumford, George S....Lavenham, Sudbury
†Mumford, Maurice...Creeting, Stowmarket
Mumford, William...Credonhill, Hereford
†Mumford, William Henry...Bramford, Ipswich
Mundy, William...Markeaton, Derby
†Munn, Maj. W. A....Throwley House, Faversham
Murdoch, James Gordon...1, Pall Mall East, S.W.
†Murray, Alex....13, John Street, Adelphi
Murton, Curteis...
Murton, Frederick...Smeeth, Ashford
Murton, Walter...East Stour, Ashford, Kent
Murton, William...Tunstall, Sittingbourne
Musgrave, Simeon...Market Weighton, Yorkshire
†Musgrave, Sir Geo., Bart....Edenhall, Penrith
Musgrave, Rev. Vernon...Mattersey, Bawtry
Muskett, Chas....Bressingham House, Diss
Muspratt, S., M.D...Royal Coll. Chemistry, Liverpool
Myott, James...Copesthorne, Congleton
Myott, Richard...Lower Overton, Congleton
Mytton, Thos...Shipton Hall, Much Wenlock

N.

†Nainby, Richard...Barnolby-le-beck, Grimsby
†Naish, W. B....Stoneaston, Bath
Nalder, J. H....Alvescott, Faringdon
Naper, Jas. L., jun....Loughcrew, Oldcastle, Ireland
†Napier, Edw. B....Pennard House, Shepton Mallet
Napier, Hon. William...2, Old Palace Yard, S.W.
Napper, John...Ifold, Horsham
Nash, Charles...Royston, Hertfordshire
Nash, Daniel...4, York Gate, Regent's Park, W.
†Naylor, John...Liverpool
†Naylor, Rich. Christopher...Hooton Hall, Chester
Neale, Charles...Mansfield Woodhouse, Notts
Neale, Charles James...Mansfield, Notts
Neame, Charles...Woodlands, Selling, Faversham
Neame, Frederick...Macknade, Faversham
Neame, Percy B....Swanton Lodge, Lydden, Dover
Neate, John Reeks...Northington Farm, Overton
Neave, Sir Digby, Bart....Dagenham Park, Romford
Neave, Sheffield...Oakhill House, Hampstead, N.W.
†Negus, Thomas A....Braunston, Northampton
†Neild, Wm....Mayfield, Manchester
Nelson, Wm. M....Cardigan Place, Leeds
Nesham, David...Houghton-le-Skerne, Darlington
Nesfield, R. M. N....Castle Hill, Bakewell
Nethercoat, John...Moulton Grange, Northampton
Neve, Charles...Shepway Court, Maidstone
Neve, George...Sissinghurst, Staplehurst
Neve, Thomas...Benenden, Staplehurst
†Nevile, Rev. Christopher..Thorney, Newark, Notts
†Nevile, George...Shebton, Newark-on-Trent
†Nevill, Rt. Hon. Viscount...Hope Hall, Tadcaster
New, Richard...Hartpury, Gloucester
†Newbery, Rich. Phelps...Challenger, Axminster
Newill, Thos...Spring Bank, Welshpool
Newcastle, Duke of...20, Portman Square, W.
Newdegate, C. N....Arbury, Coventry
Newdigate, Francis...Blackheath, S.E.
Newill, Joseph...Walcot, Lydbury, Shropshire
†Newman, J....Brands Ho., High Wycombe, Bucks
Newman, Thomas...Mamhead, Exeter
Newman, Thomas...Cray's Marsh Farm, Melksham
Newport, Viscount...30, Wilton Crescent, S.W.
Newsome, W....30, Milverton Crescent, Leamington
†Newton, G. Onslow....Croxton Park, St. Neot's
Newton, John...Grove Lodge, York
†Newton, R. J....Campsfield, Woodstock
†Newton, Thomas...The Cedars, Mitcham Common
Niblett, D. J....Haresfield Court, Gloucester
Nicholay, J. A....Cumberland Mills, Isle of Dogs
Nicholls, Lambert...Rochford, Tenbury
Nicholls, Wm....Chippenham
Nichols, Ben....West End Farm, Aldershot
Nichols, George...Spa Gardens, Leicester
Nichols, John S....Buckland, Lymington
Nicholson, Brady...Stourton Grange, Leeds
Nicholson, Charles...Staniwells, Brigg
Nicholson, J....Kirkby Thore Hall, Westmoreland
Nicholson, John...Barford St. Martin, Salisbury
Nicholson, Capt. S....Waverley Abbey, Farnham
Nicholson, Wm. Newzam...Newark-upon-Trent
Nickisson, John...Stone, Staffordshire
Nicklin, Richard...Glen Ville, Douglas, Isle of Man
Nicks, John...Leek Wootton, Warwick
Nicol, James Dyce...5, Hyde-Park Terrace, W.
†Nightingale, Vaughan E....Burway, Ludlow
†Nightingale, W. E....Embley, Romsey
Nisbet, Ralph P....Row Wood, Chalfont St. Giles
†Noakes, John Tompsett..Brockley Ho., Lewisham
Nodder, Rev. J....Ashover Rectory, Chesterfield
Noel, Eugène F....36, Westbourne Terrace W.
†Norman, George Warde...Bromley, Kent
†Norman, J.Newcomb...Harborough Magna, Rugby
†Normanby, Marq. of, K.G...Mulgrave Castle, Whitby
Norreys, Robt. H....Davy Hulme Hall, Manchester
Norrington, Charles...Cattedown, Plymouth
Norris, Rev. G. P....Roscraddoc House, Liskeard
Norris, John...Pully, Shrewsbury
†Norris, Wm....Wood Norton, Fakenham
North, Chas....South Thoresby, Alford, Lincolnsh
North, Frederick...Rougham, Norfolk
North, Lieut.-Col...Wroxton Abbey, Banbury
†Northcote, Sir Stafford, Bt., M.P....Pynes, Exeter
Northeast, Thos. Barnes...Tedworth, Marlborough
Northey, Edward Richard...Epsom
Northey, Wm....Lake, Lifton, Devon
Norton, William...
Norton, W. F. Norton...Elton Manor, Nottingham
Noton, John...Edensor, Chesterfield
†Nott, James...Penn, Amersham, Bucks
†Nottidge, Josias...Ramsgate
Nowell, W. A...Netherside, Skipton, Yorkshire
Noyes, Thomas H....Borde Hill, Cuckfield, Sussex
Nussey, John...Birstall, Leeds

O.

Oakes, Hervey Asten...Stowmarket
Oakes, Thos. Haden...Riddings House, Alfreton
Oakley, John...10, Waterloo Place, S.W.
Oakley, Richard...Lawrence End, Luton
O'Brien, Stafford...Blatherwycke Park, Wansford
Odams, James...109, Fenchurch Street, E.C.
Oddie, Walter...Colney House, St. Alban's
†Ogden, John Maude...Sunderland
Ogilvy, Sir J., Bt....Baldovan House, Dundee, N.B.
Oldacres, Matthew...Clipston, Market Harborough
Oldham, John...Carlton-on-Trent, Notts
Olding, Edmund...Rasfin Farm, Amesbury
Oldrin, Garrould...Rumburgh, Halesworth
Oliver, James...Hanford, Blandford
†Oliver, John...Pitsford Hall, Northampton
Oliver, Robert...Shoebrooke Lodge, Towcester
Oliver, Robert John...Docking, Lynn
†Olorenshaw, Joseph...Hatton Grange, Warwick
Onslow, Arthur P....Send Grove, Ripley
Onslow, Major P....Dunsbrough House, Ripley
Ord, Rev. J. A. B....Whitfield Hall, Northumberland
Orde, Charles William...Nunnykirk, Morpeth
†Orde, Sir J. P. W., Bt...Kilmorey Ho., Loch Gilp Head
Orlebar, R. L....Hinwicke House, Wellingborough
Ormerod, George...Sedbury Park, Chepstow
Ormerod, Henry Mere...5, Clarence St., Manchester

Ormond, Francis...Knossington, Oakham
Ormston, Robert...Newcastle-on-Tyne
Orton, Francis...Bottisford, Nottingham
Osborn, Charles...Down End, Fareham
†Osborn, G., jun....Manor Ho., Pattishall, Towcester
Osborne, Geo....Court Farm, Elberton, Bristol
Osborne, Henry...Weeford Park, Hints, Tamworth
Ostler, John, jun....Walrond Park, Taunton
Oswell, Thos. Basnett...Hanley Hall, Shrewsbury
Other, Christopher...Elm House, Leyburn, Yorks.
†Otrante, Count A....Nygard, Söderköping, Sweden
†Overman, Henry R....Weasenham, Fakenham
†Overman, John...Burnham, Sutton, Norfolk
†Overman, Robert...Egmere, Walsingham, Norfolk
Owen, B. H. Bulkeley...Tedsmore Hall, Salop
Owen, E. W. S....Condover, Shrewsbury
Owen, Richard...Haughton, Tarporley
Owen, William...Blessington, Ireland
Owen, William...Moorgate Hall, Rotherham
Owsley, Wm. P. Mason...Blaston, Uppingham
Oxford, Bishop of...Cuddesden, Wheatley, Oxon

P.

Pack, Thomas Henry...Ditton, Maidstone
†Packard, Edward...Ipswich
†Packe, Rev. A....Walton Rectory, Loughborough
†Packe, Geo. H....Caythorpe Hall, Grantham
†Packe, Dr. James...Melton Lodge, Woodbridge
Paddock, Henry...The Trench, Ellesmere
Padwick, Fred....West Thorney, Emsworth, Hants
Page, Bridgewater...West Cliff, Southampton
Page, Edward...Bedford
Page, Thomas...Tower Cressy, Campden Hill, W.
Paget, C., M.P....Ruddington Grange, Nottingham
Paget, E. Arthur...Thorpe, Leicester
Paget, Henry...Birstal, Leicester
†Paget, T. Tertius...Humberstone, Leicestershire
Pain, John...Popham, Micheldever Station
Pain, Philip...Boughton House, Kettering
Pain, Thomas...Laverstock Hall, Salisbury
†Paine, Mrs....Farnham, Surrey
†Paine, Wm. Dunkley...Cockshutt Hill, Reigate
Painter, John...Burley-on-the-Hill, Oakham
Paitson, William...Irish Street, Whitehaven
Pakington, Sir John, Bt....Westwood Pk., Droitwich
†Palin, William...Stapleford Hall, Chester
†Palmer, Sir Geo. J., Bart....Wanlip Hall, Leicester
Palmer, Sir J. H., Bt....Carlton Park, Rockingham
†Palmer, Rev. P. H...Wolsthorp Rectory, Grantham
Palmer, Thos....Stoke Chingland, Callington
†Palmerston, Visc., M.P., K.G...Broadlands, Romsey
Papendick, Bridget Ann...Glasbury Ho., Hay, S.W.
†Papillon, P.O., M.P...ManorHo., Lexden, Colchester
Papillon, Thomas...Crowhurst Park, Battle
Paramore, J. Rawle...Dinedor Court, Hereford
†Parker, Charles...Binfield, Bracknell, Berks
†Parker, Charles Stuart...Annesley, Liverpool
Parker, F. Sumner ..Oxton, Southwell
Parker, James...Great Baddow House, Chelmsford
Parker, J. O....Woodham Mortimer, Maldon, Essex
Parker, Rowland...Moss End, Burton, Westmoreld.
Parker, K. S., Q.C....Examiner's Office, Rolls Yard

Parker, Thomas James...10, George St., Sheffield
†Parker, Wm....Carleton Hill, Penrith
Parker, William...The Park, Ware, Hertfordshire
Parker, Maj. W., M.P....Clopton Hall, Suffolk
Parker, Rev. W...Rectory, Little Comberton, Pershore
Parker, Rev. W. H....Saham Rectory, Watton, Norf.
Parkin, John...Idridgehay, Wirksworth
†Parkinson, J., jun....Farmers' Club, Blackfriars
†Parkinson, Thomas...Hexgreave Park, Southwell
†Parkyns, Sir Thos. G. A., Bt....Ruddington, Notts.
Parr, Samuel...The Poultry, Nottingham
Parrott, Thos....Green Bank, Sutton, Macclesfield
Parry, Edward Powell...Morfodion, Llandiloes
Parry, Nicholas...Little Hadham, Ware
Parson, Rev. W. H...Lynchmere Rectory, Haslemere
Parson, William...Rivers Hall, Boxted, Colchester
Parson, Wm. N. F....Rivers Hl., Boxted, Colchester
Parsons, C., jun....N. Shoebury Hall, Rochford, Essex
†Parsons, Geo....West Lambrook, South Petherton
†Parsons, Henry...Haselbury, Crewkerne
Parsons, John...Oxford
Parton, John...Chorlton, Nantwich
Partridge, John...Bishop's Wood, Ross
†Paterson, Geo....Poyle House, Colnbrook, Bucks
†Paterson, Richard...Leesons, Chiselhurst
†Pateshall, Evan...Hereford
Patron, Simon...
Pattenson, Capt. W. H. T....Ibornden, Biddenden
Patterson, John...Hall Beck, Ulverston, Lancashire
†Patterson, W. J....Durnford Lodge, Wimbledon
Paull, Wm. Joseph...Piddletown, Dorchester
Paver, William...Peckfield, Milford Junction
Pawlett, Thos. Edward...Beeston, Sandy, Beds
†Paxton, Sir Joseph, Bt., M.P...Chatsworth, Bakewell
Paxton, Robert...Lower Winchenden, Aylesbury
Paxton, Thomas...Potsgrove, Woburn, Beds
Payne, Henry...Birdbrook, Halstead, Essex
Payne, William...Willcott, Nesscliff, Salop
Peachey, Wm....Ebernoe, Petworth
Peacock, Wilkinson...Greatford Hall, Stamford
†Peacock, Warren...Efford, Lymington
†Peacocke, G. M., M.P....33, Hertford St., May Fair
Pearce, Col. Wm....Fauconberg House, Cheltenham
†Pearse, Henry...Anningsley Park, Chertsey
Pedder, Edward...Ashton Park, Preston, Lancashire
Peel, Edmund...Bryn-y-Pys, Wrexham
Peel, George...Brookfield, Cheadle, Manchester
Peel, John...Middleton Hall, Fazeley
†Peel, Jonathan...Knowlmere Manor, Clitheroe
Peel, Sir R., Bart., M.P....Drayton Manor, Fazeley
Peel, Wm....Taliaris Pk., Llandilo, Carmarthenshire
Peel, William...Trenant Park, Looe, Cornwall
Peele, Henry...Durham
Peers, Joseph...Ruthin
†Peile, Thos. Williamson...Tullihinel, Kerry
Peirson, John...24, Micklegate, York
†Pell, Albert...Hazelbeach, Northampton
†Pell, Sir Watkin O....Royal Hospital, Greenwich
Pellatt, Apsley...Knowle Green, Staines
Pelly, Sir John Henry...Warnham Court, Horsham
Pelly, Capt. R. Wilson...The Willows, Upton, Essex
†Pemberton, Rev. R. N....Church Stretton, Salop
†Penn, Granville J....

Pennant, P. P....Brynbella, St. Asaph
Pennell, H. B....Dawlish
Pennell, Rich. Lewin...Venbridge, Exeter
Pennington, Richard...Westfield House, Rugby
Penrice, Thomas...Kilvrough, Swansea
†Peploe, Capt. Daniel Peploe...Garnston, Hereford
Pepper, John...3, Queen Street, Leeds
Pepper, William...Clarendon Mount, Leeds
Peppercorne, H....Bradburn Pk., East Malling
†Perales, Marquis de...Madrid
†Perceval, Chas....West Haddon, Northamptonshire
Percival, Ralph H....Tetton Hall, Middlewich
Peren, W. B....Compton, South Petherton, Somerset
Perkins, A....Westfield Ho., Market Harborough
Perkins, John S....Leek Wootten, Warwick
Perkins, Charles...The Grange, Kingston, Taunton
†Perkins, Thomas...Hitchin
†Perry, Thos. A...Betham Ho., Avon Dasset, Banbury
Perry, Sir T. E., M.P....West Court, Berkshire
Perry, William...Cholstrey, Leominster
Perry, Wm....Alder Lewdown, Exeter
†Perry-Watlington, J. W., M.P....Moor Hl., Harlow
Pertwee, J. F....Rattendon, Wickford, Essex
Peters, Daniel...31, College Green, Bristol
†Peto, Sir S. M., M.P....Somerleyton Hall, Suffolk
Petman, Robt....Ashley House, Folkestone
Phelips, Charles...Briggins Park, Ware
†Philips, Sir G. R., Bart....Shipston-on-Stour
Philips, Mark...Snitterfield, Stratford-on-Avon
Phillimore, Rev. G....Radnage, Stokenchurch, Oxon
Phillipps, James...Bryngwyn, Ross, Herefordshire
†Phillipps, Robt. Biddulph...Longworth, Hereford
Phillipps, J. B. L....Penty Park, Haverfordwest
Phillipps, Wm....The Lodge, Reigate
Phillips, Henry R....Willesden, Paddocks, Kilburn
Phillips, John...Lordship Lane, Tottenham
Phillips, J. B....Brockton Leasows, Newport, Salop
Phillips, Rev. John...Ludlow, Salop
†Phillips, J. H....Beadlam Grange, Nawton, York
Phillips, J. R. S....Riffhams, Chelmsford
Phillips, Joseph Taylor...Sheriff Hales Manor, Salop
Phillips, Sir Thos., Knt....Llaenllan, Abergavenny
Phillips, Maj.-Gen. Sir T., Knt....Senior U. S. Club
Phillips, Thomas E....37, Wilton Place, S.W.
†Phillpotts, T., jun....Risca, Newport, Monmouthsh
†Phipps, C. Paul...Chalcot House, Westbury
Phipps, Christopher...River, Dover
†Phipps, John Lewis...Leighton, Westbury, Wilts
Pickering, Leonard...Wilcot, Charlbury, Oxon
†Pickford, William...148½, Fenchurch Street, E.C.
Pickin, W. C....Dunham, Notts
Pickin, Wm. John...Whitemoor, Ollerton, Notts
†Piercy, Alfred...Cold Harbour, Henley, Oxon
†Pierson, Jas. Alex....The Gwynd, Arbroath, N.B.
Piggot, Jas. Algernon...Beckingham Hall, Witham
†Piggott, Geo. G....Gwydyr House, Whitehall
Piggott, Simon Frazer...Fitzhall, Midhurst, Sussex
Pigott, Sir Robert, Bart....Patshill, Wolverhampton
Pike, James...Reading
Pike, William...Steventon, Beds
Pilbearn, Thomas...Henham, Wangford
Pilcher, Jesse...Cheriton Court, Hythe, Kent
Pilgrim, Charles H....
Pilgrim, S. C...Manor House, Burbage, Hinckley
†Pilkington, Sir L. M. S., Bart....Wakefield
Pillans, Wm....
Pillias, Alexander...Bursledon, Southampton
Pimlett, Josh....Norton-in-Hales, Market Drayton
Pinckhard, George H....Combe Court, Godalming
Pinckard, John Thomas..Handley, Towcester
Pinder, Thomas...Barroby, Grantham
†Pinnegar, C....Rockbourn, Fordingbridge, Hants
Pinney, Col. W., M.P....Somerton-Erleigh, Somers.
†Pipon, Capt M....Deerswood, Crawley
Pippet, William...Caughton House, Bromsgrove
Pitcairn, Alex....Easdale, Castle Oban, Argylesh.
Pitfield, A. J...Eype, Symondsbury, Bridport
Pitman, James S....Dunchidcock House, Exeter
Pitt, George...Chadnor Court, Dilwyn, Leominster
Plant, John...Model Mill, Sheffield
Plant, Thomas...Elworth Hall, Sandbach, Cheshire
Platt, Henry...Werneth Park, Oldham
Platt, James...Newton, Malpas
Plowden, W....Plowden Hall, Bishop's Castle, Salop
Plowman, Joseph...Oxford
Plumbe, John...Ashton Keynes, Cricklade
Plumptre, J. B....Goodnestone Farm, Wingham
Plumptre, J. P....Fredville, Wingham, Kent
†Pocock, Chas....
Pocock, George...Redbourn Bury, Redbourn
Pointon, George...Mere Cottage, Lawton, Cheshire
Pole, H. Chandos...Barton Fields, Derby
Pole, Sir Peter Van Notten, Bt....6, Upper Harley St.
Pole, Rev. Reginald Chandos...Radbourne, Derby
†Pollard, Joseph....Highdown, Hitchin
Pollen, Sir J. W., Bt....Redenham, Andover
†Pollen, R. H....Radbourne, Chippenham
Pollock, J. O. G...Mountain's Town, Navan, Ireland
Pomfret, Earl of...Easton Hall, Towcester
†Pomfret, Virgil...Tenterden, Kent
Poole, Domville...Marbury, Whitchurch, Shropshire
Pooly, Thomas...North Wold, Norfolk
Pope, Edward...Great Toller, Dorchester
Pope, John...Symondsbury, Bridport
Pope, J. Raymond...Shipridge Farm, Mitcheldean
Pope, Thomas...Harewood, Bletchingly, Surrey
Porcher, Charles...Cliffe, Dorchester
Portal, M....Laverstoke House, Micheldever Station
Porter, Maj.-Gen....Mintern House, Dorchester
Porter, Thos....Bawnton, Cirencester
Porter, Wm....Hembury Fort, Honiton
†Portman, Hon. W.H.B., M.P...Bryanston, Blandf.
†Portsmouth, Earl of...Eggesford Ho., North Devon
Postlethwaite, Thomas....Offley Hotes, Hitchin
Potter, John...Basinghall Street, Leeds
Potter, T. B....Bush Hill, Manchester
Powell, Evan....Trewythen, Llandinam, Montgom.
Powell, George...8, Beaufort Buildings, Strand
Powell, John...Watton Mount, Brecon
Powell, John Thomas...Easton, Pewsey, Wilts
Powell, J. Folliot...7, Albion Place, Hyde Park, W
Powell, Richard...Benson, Oxon
†Powell, Rev. S. H...Sharon Hall, Ripon
†Powell, Thos. H...Drinkstone Pk., Woolpit, Suffolk
†Powell, T., jun....Coldra, Newport, Monmouthsh.
Powell, Wm...Eglwgs Nunydd, Taibach, Glamorg.

Powell, Wm....Tickford Abbey, Newport Pagnell
†Power, K. Manley...Hill Court, Ross, Herefordshire
†Powlett, Lord William...Downham Hall, Brandon
†Poynder, T. H. A....Hartham Park, Corsham
Pratt, Edward...Caldwell, Burton-on-Trent
Pratt, Rich. Fred....Gt. Sanders, Sedlescomb, Battle
Preece, John...Cressage, Salop
†Prentice, Manning...Stowmarket
Prescott, William...Clarence, Roehampton, S.W.
†Preston, Capt. J. N...FlasbyHl., Gargrave-in-Craven
Preston, Thomas...Scosthrop Ho., Bell-Busk, Leeds
†Pretyman, Arthur...Camp Hill, Nuneaton
Price, Charles...Querrington, Fairford
Price, Richard G....Norton Manor, Presteign
Price, Thomas...Querrington, Fairford
Price, William...Glantwick, Swansea Valley
Price, Wm. Philip, M.P....Tiberton Ct., Gloucester
Prickard, Thos....Dderw, Rhayader, Radnorshire
Priday, Samuel...Linton, Gloucester
Pride, William...Lanvihangel, Chepstow
Prideaux, Sir Edm. S., Bart....Netherton, Honiton
Priest, Alfred...Kingston-on-Thames
Priestley, J....Hirdrefaig, Bangor, Isle of Anglesea
Priestley, S. O....Trefan, Pwllheli, Carnarvonshire
Princep, William...Newton, Tamworth
†Pritchard, George...Broseley, Salop
†Pritchard, John...Broseley, Salop
Pritchard, Robt....Llwydiarth Esgob, Bangor
†Probyn, Edmund...Huntley, Gloucestershire
Proctor, Thomas...Cothay, Wall's Court, Bristol
†Prodgers, Herbert...Kington House, Chippenham
Pronger, James...Beeding, Horsham
†Prosser, Francis Wegg, M.P....Belmont, Hereford
Prout, John...Sawbridgeworth, Herts
Pryke, John P....Aldersfield Hall, Wickhambrook
Pryor, Morris...Baldock, Herts
Pryse, John Pugh...Bwlchbychan, Lampeter, S. W.
Pryse, Capt., M.P....Gogerdan, Aberystwith
Puckle, T. Broadhurst...Woodcote Grove, Carshalton
Pugh, David, M.P...Llanerchydol, Welshpool, Montg.
†Pugh, William...Coal Port, Ironbridge, Salop
Puleston, Rev. T....Worthenbury Rectory, Flintsh.
†Pulleine, James...Crakehall, Bedale
†Puller, Christopher W...Youngsbury, Ware
Pullin, James...Wraysbury, Staines
Pullin, Stephen...Mildridge Farm, Horton, Slough
Pulteney, J. G. B....Portslade House, Shoreham
†Punnett, P. Simpson...Chart Sutton, Staplehurst
Punchard, Charles...Blunt's Hall, Haverhill, Suffolk
Purser, Edward...116, Fenchurch Street, E.C.
Purton, Wm....The Woodhouse, Cleobury-Mortimer
Purves, Peter...The Grove, Brampton, Huntingdon
Pusey, S. E. B....Pusey House, Faringdon
Pyatt, Abraham...Wilford, Nottingham
Pye, Geo....Cublington, Madley, Herefordshire
†Pye, Henry Abington...Louth, Lincolnshire

Q.

Quartly, Jas....Molland House, South Molton
Quartly, John...Champson Molland, South Molton
Quinn, P., J.P....Agency, Poyntz Pass, Ireland

R.

Racster, William...Withington Court, Hereford
Radcliffe, Rev. Walter...Warleigh, Plymouth
Radford, H. B....Stanton Ho., Burton-on-Trent
†Raincock, H. D....Croydon
Raine, William Surtees...Gainford, Darlington
Rainforth, Edward...Monkhopton, Bridgnorth
Ralph, R. W....Honnington Grange, Newport, Salop
Ralston, James...Danesfield, Great Marlow
Ralston, Wm. Henry...Keele, Newcastle, Staffs.
Rammell, Thomas...Sturry Court, Canterbury
Ramsay, John...9, Endsleigh Street
Ramsbotham, J...Crowborough Warren, Tunb. Wells
Ramsey, G. H....Derwent Villa, Newcastle, North.
Ramsden, Robert...Carlton Hall, Worksop
Rand, William...Saffron Walden
Randall, Alexander...Maidstone
Randell, Charles...Chadbury, Evesham
Randell, James R....Chadbury, Evesham
Randolph, Vice-Ad. C. G....Gt. Comp, Sevenoaks
Randolph, Lt.-Col. C. W....5, Victoria Sq., Pimlico
Ranford, Chas...12, Hamilton Ter., New Cross, S.E.
Ranger, H. W....Manor Ho., Ashurst, Tonbridge Wells
Ranken, W. B....Abbott's Langley House, Herts
Rankin, John...Union Foundry, Liverpool
Ransome, Frederick...Ipswich
Ransome, James Allen...Ipswich
Ransome, J. E....Bolton Hill, Ipswich
Ransome, R. C....Bolton Hill, Ipswich
Ransome, Robert...Ipswich
Ratcliff, R....Hodare Farm, Hartfield, Tunbridge
Ratleff, William...Newmarket
Rawes, John...Springwood Cottage, Chorley
Rawlence, James...Bulbridge, Wilton, Salisbury
Rawson, Charles...Glanhenwyr, Glasbury, Hereford
Rawson, Richard...Wheat Hill, Roby, Prescot
Ray, Henry...Bristol
†Ray, Samuel...St. Paul's, Belchamp, Halstead
Rayer, John...Eastington, Northleach
Rayer, Wm. Carew...Tidcombe, Tiverton
†Raynbird, Hugh...Church Street, Basingstoke
Raynbird, Robert...Hengrave, Bury St. Edmund's
Rayner, Henry...Ely
Rea, James...Monaughty, Knighton, Radnorshire
Rea, Thomas..Westonbury, Pembridge, Leominster
†Read, Clare Sewell...Plumstead, Norwich
†Read, Geo., jun....Baxton Hall, Brandon, Norfolk
Read, James...Whittlesea
Read, James Marsh...Elkstone, Cheltenham
Read, Richard...35, Regent Circus, Piccadilly, W.
Rees, W. Treharne...Holly House, Newport, Mon.
Reeve, Major-Gen....Leadenham, Grantham
Reeves, J. R....Hantsland, Crawley Down, Sussex
Reid, Sir John Rae, Bart....The Grove, Ewell
Relph, G. R. Greenhow...Beech Hill, Usk
Rendle, William Edgcumbe...Plymouth
Reynardson, Henry Birch...Adwell, Tetsworth
Reynolds, Joseph Benj....Lubbesthorpe, Leicester
†Reynolds, Dr. William...Coed-dû, Mold
Rhodes, C....Little Oat Hall, Wivelsfield, Sussex
Rhodes, J. Armitage...Roundhay, Leeds

Rhodes, James...Seal Lodge, Farnham, Surrey
†Ricards, Mortimer...Bure Homage, Christchurch
Rice, Edward Royd...Dane Court, Wingham
Rich, Stiles...Didmarton, Chippenham
†Richards, Edward Priest...Cardiff
†Richards, John...Llyncleys, Oswestry
Richards, W...Nyoddfraith, Newtown, Montgom.
Richardson, G....Bridlington Quay, Yorkshire
Richardson, Henry...Cherry Hill, York
Richardson, J...Northlands House, Winterton, Brigg
Richardson, John...Asgarby, Spilsby
Richardson, J. W....Willoughton, Kirton-in-Lindsay
Richardson, Sir J. S., Bt....Pitfour Castle, Perth, N.B.
Richardson, Jonathan..Glenmore, Lisburne, Antrim
†Richardson, Robt.....Cunningham, Londonderry
Richardson, T. M....Hibaldstow Grange, Kirton
Richardson, Capt. Thos....Sutton Hurst, Lewes
†Richmond, Duke of...Goodwood, Chichester
Richmond, Francis...Salford, Manchester
Rickard, Martyn William...Devonport
Riddell, E....Cheeseburn Grange, Newcastle-on-Ty.
†Riddell, Sir W. B., Bt...Hepple Rothbury, Morpeth
Rider, Joseph...Leeds
Ridge, T. J....Hambledon, Horndean, Hampshire
Ridgway, Capt. Alex....Blackanton, Totnes
Ridgway, John...Fairlawn, Wrotham, Kent
†Ridgway, J....Cauldon Pl., Shelton, Stoke-on-Trent
Ridgway, Thomas...Lymm, Warrington
†Ridler, Richard H....Shobden, Herefordshire
Ridley, J....Park End, Hexham, Northumberland
Ridley, J. M....Walwick Hall, Hexham, Northumb.
Ridley, Rev. N. J... Hollington House, Newbury
Ridley, T. D....Chelmsford
Rigby, Thomas...Finney Wood, Winsford, Cheshire
Rigden, Richard Henry ..Salisbury
Rigden, William...Hove Farm, Brighton
Rigg, Joseph...Filloughby, Coventry
Riley, Edmund...South Dalton, Beverley
†Riley, Luke...Meriden, Coventry
Riley, W. F....Forest Hill, Windsor
Rimell, R., jun....Tedney, Whitbourne, Worcester
Ringer, John...West Harling, East Harling, Norfolk
Rinnell, Wm...Berrington Court, Campden, Glouces.
Rising, Robert...Horsey, Great Yarmouth
Rising, Wm....Somerton Hall, Great Yarmouth
Risley, Rev. W. C....Deddington, Banbury
Rivers, Lord...Rushmore Lodge, Ludwell, Salisbury
†River, John...
Rix, Benjamin...St. Matthew's, Ipswich
Roads, J....Ashmore Farm, Addington, Winslow
†Robarts, A. J....Lillingstone Dayrell, Bucks
Roberts, Bennett S....10, Abbey Square, Chester
Roberts, Charles G....Woodcote, Charshalton, S.
Roberts, Edw....Almshoe Bury, Hitchin
Roberts, Joseph...Southleigh, Truro
Roberts, Richard...Burrington, Ludlow
Roberts, Thomas Lloyd...Crofton Hall, Bromfield
Roberts, Thomas...Ivington Bury, Leominster
Roberts, Wm. Harvey...Trewhiddle, St. Austell
†Roberts, Wightwick...Trethill, Sheviock
Robey, Robert...Canwick Road, Lincoln
Robinson, D....Clitheroe Castle, Clitheroe
Robinson, George...Whiston, Shiffnall
Robinson, Isaac...Iron Foundry, Halesworth
Robinson, Jas....Huggart's Farm, Brindle, Chorley
Robinson, John...Mark Lane, Leeds
Robinson, John...Wootton Lodge, Gloucester
Robinson, John G....Oakley Hl., Bishop's Stortford
Robinson, Sir John S., Bart....Rokeby Hall, Louth
†Robinson, Jos....Clifton Pastures, Newport Pagnel
Robinson, Richard...Utkington, Tarporley
Robinson, Thomas...Nuthill, Hedon, Yorkshire
Robinson, Thomas...Castle Ashby, Northampton
Robinson, William...Bone Hill, Tamworth
Robinson, William...Heatley Lymm, Cheshire
Robson, James...Brackenborough, Louth
†Robson, John...East Kielder, Bellingham
Robson, William...Wilton, Salisbury
†Roch, Nicholas...Paskiston, Pembroke
Rocke, James John...Glastonbury
†Rodd, F. H....Trebartha Hall, Launceston
Roddam, J. J....Newtown, Stanhope, Darlington
Roddam, Wm...Roddam, Wooller, Northumberland
Rodwell, William...Woodlands, Holbrook
†Roebuck, J. A., M.P....19, Ashley Place, Pimlico
Rogers, Henry...Stagenhoe Park, Welwyn
†Rogers, John J....Penrose, Helston
†Rolfe, C. Fawcett Neville...Sedgeford Hall, Lynn
Rolls, John E. W....The Hendre, Monmouth
Rolt, John...Ozleworth Park, Gloucester
Rome, Thomas...Groundslow, Stone, Staffordshire
Romilly, Edward...Porthkerry, Cardiff
Romney, Earl of...The Mote, Maidstone
†Rooper, George...Nascott House, Watford
†Rooper, J. B....Abbotts Ripton, Hunts
Root, William...Chipping Warden, Banbury
†Roper, R. S. D. R....Sedbury Pk., Richmond, Yks.
Rose, Philip...Rayners, High Wycombe, Bucks
Ross, James...Hoo Park Farm, Luton
†Rothwell, R. R....Sharples Hall, Bolton, Lancashire
Rotton, Richard...3, Boltons, Brompton, S.W.
Round, Chas. Grey...Birch Hall, Colchester
Rous, Col. G....33, Conduit Street
Rous, Hon. Wm. Rufus...Worstead House, Norwich
Row, Wm. North...Cove, Tiverton
Rowe, Samuel...Duddon Lodge, Tarporley
Rowe, W. Wevill...Miltons Abbot, Tavistock
Rowland, Edward...Claygate House, Esher
Rowland, John...Islip, Oxford
†Rowland, R....Creslow, Aylesbury
Rowley, George W....St. Neot's
Rowley, Hon. R. T...Rhyderddwyn Faur, Rhuddlan
Rowley, John Geo....Rockstowes House, Dursley
Rowley, John Jephson...Rowthorne, Chesterfield
†Royds, Albert Hudson...Falinge, Rochdale
†Royds, Rev. John...Heysham Rectory, Lancaster
†Royston, Viscount...Wimpole, Cambridgeshire
Ruck, Edmund...Castle Hill, Cricklade
Ruck, Lawrence...9, Staple Inn, W.C.
Rudyard, Francis...Bunker's Hill, Lincoln
Rudyerd, Henry...
Rumball, Henry..Grove House, Cleckheaton, Leeds
Rumbold, C. J. A....5, Percival Terrace, Brighton
Ruse, Robertson...Warfield, Bracknell, Berks
†Russell, Lord C. J. F....Drakeloe Lodge, Woburn
Russell, Sir Chas., Bt....Swallowfield, Reading
Russell, David...Clifton Lodge, York

Russell, G. Lake...62, Lowndes Square, S.W.
Russell, James...Brimstage, Birkenhead
Russell, John...Piercefield Park, Chepstow
†Russell, Robert...Pilmuir, Leven, Fife
Russell, Robert...Farningham, Dartford
†Russell, Sir W., Bt., M.P...Charlton Pk., Cheltenham
Rust, James...Alconbury, Huntingdon
Rust, Wm. Holyoake...Good Easter, Chelmsford
Ruston, A. S...Aylesbury Ho., Chatteris, Isle of Ely
Ruston, Joseph...Lincoln
Rutson, Wm....Newby Wisk, Northallerton
Rutzen, Baron F. de...Slebeck Hall, Haverfordwest
†Ryder, Hon. G. D....Westbrook, Hemel Hempsted
Ryder, T. B....2, Elliot St., Clayton Sq., Liverpool
Ryland, T....Gt. Lister Street Works, Birmingham
Rylatt, W....Branswell, Sleaford

S.

Sabin, John...Harbury, Southam, Warwickshire
Sadler, Henry...Mid-Lavant, Chichester
Sadler, T. W....Norton Mains, Ratho, Edinburgh
Sadler, Thomas...Chiddingfold, Surrey
Sadler, William...Chiddingfold, Surrey
Sadler, Wm....Ferry Gate, Dirleton, Haddingtonsh.
Sadler, William James...Calcutt, Cricklade
Sainsbury, W....Hunts Ho., W. Lavington, Devizes
†St. Albans, Duke of...Redbourne Hall, Brigg
†St. Maur, Lord Archibald...Burton, Loughborough
†St. Leger, A. F. Butler...Park Hill, Rotherham
Sallit, Matthew...Saxlingham, Norwich
†Salkeld, Thomas...Holme Hill, Carlisle
Salomons, David...Broom Hill, Tonbridge
Salt Herbert...Methley Park, Leeds
Salt, Thomas...Weeping Cross, Stafford
Salt, Titus...Methley Park, Leeds
Salter, W. P., jun....The Abbey, Thetford
Saltmarshe, Philip...Saltmarshe, Howden
Salusbury, Rev. Thelwall J. T....Offley, Hitchin
†Salvin, M. C...Sarnsfield Court, Kington, Hereford
Samman, Wm....Middleton Park, Bicester
Samman, John...Broadwell, Moreton-in-the-Marsh
Sampson, H. Atkins...Rowney Abbey, Ware
Sampson, Thomas...Moor Hall, Ninfield, Battle
Samuelson. B....Britannia Iron Works, Banbury
Sanday, W....Holme-Pierrepoint, Nottinghamshire
†Sandbach, H. R. ..Hafodunos, Llanrwst, Denbighs.
Sanders, E. A....Stoke House, Exeter
Sanderson, Hastings...5, Brinswood E., Leamington
Sanderson, Jas. ..15, Manchester Bdgs., Westminster
†Sandford, Marks...Martin, Dover
Sandham, Major...Rowdell, Steyning
Sandle, Wm....52, Upper Brunswick Pl., Brighton
Sandwich, Earl of...Hinchingbrooke House, Hunts.
Sankey, Robert...Canterbury
Satchwell, T...Hernfield Ho., Knowle, Birmingham
†Satterfield, Joshua...Alderley Edge, Manchester
Saunders, James...St. Paul's, Clapham, S.
Saunders, Randle Wm....Nunwick Hall, Penrith
†Saunders, Thos. B....Priory, Bradford-on-Avon
Saunders, T. H....Watercombe, Dorchester, Dorset
†Saunders, William Wilson...Hillfield, Reigate
Savery, A. B....Hardwick Lodge, Chepstow
Savidge, Mat....Churchill Mount, Chipping Norton
Savory, James...Tewkesbury
Savory, Paul Haines...Gloucester
†Savignon, Don D. (Mexico)...23, Royal Exch., E.C.
Sawyer, Charles...Heywood Lodge, Maidenhead
Saxby, Thomas...West Firle, Lewes
Saxelby, Thos....Urecote Hall, Hampton-in-Arden
Say, R. Hall...Oakley Court, Windsor
Sayers, John...Field Dalling, Holt, Thetford
Scarborough, John L....Colyford, Axminster
Scarsdale, Lord...Kedleston Hall, Derby
Scarth, Edw....Westside House, Darlington
Scarth, Jonathan...Shrewsbury
Scarth, Thos. Freshfield...Keverstone, Darlington
Scarth, William Thomas...Keverstone, Darlington
Schollick, E. Jones...Aldingham Hall, Ulverston
Schramm, Rudolph...Grove Park, Camberwell, S.
Schreiber, Capt. T. W....Melton, Woodbridge
†Schwann, F. S...N. Houghton Manor, Stockbridge
Scoones, H. B....Fowle Hall, Brenchley, Kent, S.W.
Scott, Col. Hon. C. Grantham...79, Eaton Sq., S.W.
Scott, Jas. Winter...Rotherfield Park, Alton, Hants
Scott, John B....Bungay, Suffolk
Scott, J....Green Head, Milnthorpe, Westmoreland
Scott, Joseph...Colney Hall, Norwich
Scott, Thomas...Broomhouse, Beal, Northumberland
Scott, Thomas... 18, Parliament Street
Scott, Thomas Edward...Crondall, Farnham, Surrey
Scott, William...Empshot Grange, Petersfield
Scragg, Thomas...Calveley, Tarporley
†Scragg, William...Great Clacton, Colchester
†Scratton, D. R....Prittlewell Priory, Rochford
Scriven, George...Castle Ashby, Northampton
Scudamore, Lt.-Col....Kentchurch Court, Hereford
Seager, James Lys...Carroun Ho., S. Lambeth, S.
Seal, Charles Wm....Leighdelamere, Chippenham
Seamark, Richard...Mount St. Alban's, Caerleon
Searson, R....Cranmore Lodge, Market Deeping
†Sebright, Sir T. G. S., Bart....Market Street, Herts
†Sedgwick, Professor...Trinity College, Cambridge
Seels, Henry John...Wainfleet Hall, Lincolnshire
Selmes, James...Tufton Pl., Northiam, Staplehurst
Senhouse, Capt. Wm....Ashby St. Ledgers, Rugby
Seppings, T. Johnson...South Creake, Fakenham
Sergeantson, Geo. John...Camp Hill, Ripon
†Severn, J. P...Penybont Hall, Penybont, Radnorsh.
Seward, Samuel...Weston, Petersfield
Sewell, Daniel...Beaumont Hall, Colchester
Sewell, Rev. Thos....The Cottage, Bolney, Cuckfield
Sexton, George...Wherstead, Ipswich
†Sexton, G. Mumford...Wherstead Hall, Ipswich
†Seymer, H. K., M.P....Hanford, Blandford
Seymour, H. D., M.P...Knoyle House, Hindon, Wilts
Seymour, Col....Windsor
†Seymour, Rev. Sir J. H. C....Berkhampstead
Shackel, George...Earley Court, Reading
Shackle, Thomas...Hayes, Uxbridge
Shackleton, John...Scarcroft, Leeds
Shafto, Rev. John D....Buckworth Rectory, Hunts
Shafto, R. D., M.P....Hampworth Lodge, Salisbury
Shafto, T. D....CheveneyHouse, Hunton, Maidstone
Shaftesbury, Earl of...St. Giles', Cranbourne
Shann, Charles...Inholes, Tadcaster
Sharman, S....Home Farm, Little Crosby, Liverpl.

Sharp, Henry Morton...Monks Hardwicke, St. Neots
Sharp, Isaac...Dairyknoll, Middlesborough-on-Tees
Sharp, William...Shottesbrook, Maidenhead
Sharpe, Robert...Hewelsfield Court, Chepstow
Sharpe, William...Mavis Enderby, Spilsby
Shaw, Alex. Nesbitt...Newhall, Fortrose, Rosshire
Shaw, Chas. Henry...Woodbine Cottage, Hackney
Shaw, H. Geo....The Hollies, Wilneslow, Cheshire
†Shaw, John...Beddington Lodge, Croydon
Shaw, John...Britannia House, Banbury
Shaw, John...Huntsbury Hill, Northampton
Shaw, Rev. M...Rougham Rectory, Bury St. Edmund's
Shaw, William...Cold Norton, Stone, Staffordshire
Shaw, William...Far Coton, Northampton
†Shawe, R. F....Brantingham Hall, Hull
Shearer, B. P....Swanmore House, Bishop's Waltham
Sheffield, Earl of...Sheffield Park, Uckfield
Sheffield, Sir R., Bt....Normanby Park, Brigg
†Sheild, W. H....Landawke, Langharne, Carmarthen
Shelburne, Earl of...Bowood, Calne, Wilts
†Sheldon, H. J....Brailes House, Shipston-on-Stour
†Sheldon, John...Western Hill, Durham
†Sheldon, Jonathan...Eynsham, Oxford
Sheldrake, E....Ixworth, Thorpe, Bury St. Edmund's
Shepheard, Joseph...Torpoint, Cornwall
Shepherd, Edw....Bovington Farm, Wool, Wareham
Sheppard, J. G....Ashe High Ho., Wickham Market
†Sherard, Lord...Glatton, Stilton, Hunts
Sherborn, Francis...Bedfont, Middlesex
†Sherborn, Francis, jun....Bedfont, Middlesex
Sherbrooke, H. Porter...Oxton, Southwell, Notts
Sheridan, R. B., M.P....Frampton Court, Dorchester
Sherrard, Jas. Corry...Kinnersley Manor, Reigate
Sherriff, William...Treworgan, Llangarren, Ross
Shingler, Hugh...Hopesay, Aston-on-Clune, Salop
Shirley, Thomas...Newport, Bishop's Stortford
Shittler, Wm. Rowden...Bishopstone, Salisbury
†Shubrick, Lieut.-Gen....The Grove, Leatherhead
†Shuter, James...Crookham, Newbury
†Shuttleworth, Joseph...Hartsholme Hall, Lincoln
Sibley, Robert...Annable's Farm, Luton
Sidney, S....St. Alban's Cottage, Northend, Fulham
Sikes, John...Sudbury, Suffolk
Sill, Rev. J. P....Witheringsett Rectory, Stonham
Sills, William...Casthorpe, Grantham
†Sillifant, John...Coombe, Copplestone, Devon
Silver, Rev. F....Norton-in-Hales, Market Drayton
Silvester, Francis R....St. Albans
Simcoe, Rev. H. A....Penheale, Launceston
Simeon, Sir J., Bart....Swainston, Isle of Wight
Simmons, Thos....East Peckham, Tonbridge, Kent
Simon, James...Greenfield, Holywell, Flintshire
Simonds, W. Barrow...Abbott's Barton, Winchester
†Simonds, J. Cabourne...Fishtoft, Boston
†Simonds, Thomas...Marske, Redcar
Simpkin, Benjamin...Hoby, Leicestershire
Simpson, Alex....Teawig, Beanly, Inverness-shire
Simpson, Alexander...Snow Hill, Birmingham
Simpson, Benjamin Soulby...Boston
Simpson, E. Thornhill...Walton, Wakefield
Simpson, H. Bridgman...Babworth, Retford, Notts
Simpson, John...Pyle Hotel, Bridgend
Simpson, John...East Barnet
Simpson, John...Potterspury, Stony Stratford
Simpson, Joseph...Spofforth Park, Weatherby
†Simpson, Pinder...29, Saville Row, W.
Simpson, Rich....The Cliffe, Douglas, Isle of Man
Simpson, S. W....North Laiths, Rufford, Ollerton
Simpson, Thos....High Street, Lincoln
Sims, W. Dyllwyn...Ipswich
Sinclair, John...Glenurquhach, Inverness
†Sisson, Robert James...Talardy, St. Asaph
Sitwell, Rev. H. W....Stainsby House, Derby
Sitwell, Robert Sacheverill...Merley, Derby
Skelton, Spencer...Sutton Bridge, Wisbeach
Skelton, W...Sutton Bridge, Long Sutton, Lincolnsh.
Skillicorne, W. Nash...Cheltenham
Skipworth, W....South Kelsey, Brigg
Skirving, William...15, Queen Square, Liverpool
†Slade, A. F....Kemmal House, Chiselhurst
†Sladen, Charles...Geelong, Victoria, Australia
Sladen, Douglas B....2, King's Arms Yard, E.C.
Sladen, Joseph...Hartsbourne Manor, Bushey Heath
Sladen, St. Barbe...14, Parliament Street, S.W.
Slaney, W. H....Hatton Grange, Shiffnall
Slater, Cyrus...Dunkirk, Holmes Chapel
Slater, Martin...Weston Colville, Newmarket
Slator, Thomas...Market Place, Boston
Slatter, William...Stratton, Cirencester
Sleigh, Holmes...Ellerton Grange, Newport, Salop
Slye, Wm. Walter...Beaumont Castle, Lancaster
Smallbones, G. B....Sternickel & Lintenis, Vienna
Smallpiece, Job...Compton, Guildford
Smart, G....Woodhouse Grange, Aberford, Milford
Smart, Major George John...Tumby, Boston
Smart, William Lynn...Linden, Woburn
Smedley, C. E. B....The Grange, Revesby, Boston
Smijth, Sir William Bowyer, Bt....Hill Hall, Epping
†Smith, Abel...Woodhall Park, Hertford
Smith, Apsley...Baxterley Hall, Atherstone
†Smith, Augustus...1, Eaton Square, S.W.
Smith, Charles Edward...84, Eccleston Square
†Smith, Sir Chas. Cunliffe W....Suttons, Romford
†Smith, C. R....Filkin's Hall, Lechlade
Smith, D., jun....Martley Hall, Wickham Market
†Smith, Edw....Ratcliffe-on Trent
†Smith, Edward James...14, Whitehall Place, S.W.
Smith, Felix...Upton Bishop, Ross
†Smith, George...The Luham, Penrith
Smith, Graham...Easton Grey, Malmesbury
Smith, G. P....Lower Eaton House, Hereford
Smith, Geo. Robt....Selsdon Park, Croydon
Smith, Henry Abel...Welford, Nottingham
Smith, Henry...Cropwell, Bingham, Notts
Smith, Henry...Drax Abbey, Selby, Yorkshire
Smith, Henry Trefusis...Devonport
Smith, Hen...New House, Sutton Maddock, Shiffnal
Smith, Henry...Brierly Hill, Dudley
Smith, Hugh...Pudlicott House, Enstone, Oxon
Smith, James...Stanstead, Chichester
Smith, Jeremiah...Springfield, Rye
Smith, J. A....Bradford Peverell, Dorchester
†Smith, J. Hesletine...Perrot's Brook, Cirencester
†Smith, J. Metcalf...Leeds
†Smith, John...
Smith, John...Fradswell Hall, Stone, Staffordshire

Smith, John...Crownthorpe, Wymondham
Smith, John...Marton Lodge, Bridlington
Smith, John...Sevenhampton, Andoversford
†Smith, Sir John J., Bt....Down House, Blandford
Smith, John Kennedy...Radbrook Villa, Shrewsbury
Smith, John Philip...Lower Wick, Worcester
Smith, Rev. John Tetley...Repton, Burton-on-Trent
Smith, John T....Thornby Grange, Guilsborough
Smith, Joseph...Henley-in-Arden
Smith, Joseph Lambourne...Ledbury, Hereford
Smith, Martin T., M.P....13, Upper Belgrave St. S.W.
Smith, M. P...7, Leinster Gardens N., Cleveland Sq.
Smith, Richard...Tunbridge Wells
Smith, Richard Booth...Huxley Farm, Edmonton
Smith, Robert...Heath Farm, St. Alban's
†Smith, Robert...Goldings, Hertford
Smith, Robert...Emmett's Grange, South Molton
Smith, Robert Thursfield...Whitchurch, Salop
Smith, Thomas Robert...Shareshill, Wolverhampton
Smith, Thomas...Colebrook Park, Tunbridge
Smith, Rev. S....Lois Weedon Vicarage, Towcester
†Smith, Sir Wm., Bt....Eardiston House, Worcester
Smith, Wm....West Rasen, Mkt. Rasen, Lincolnsh.
†Smith, William...Winchcomb, Gloucestershire
†Smith, William...Bibury, Fairford
Smith, William...Gathorpe, Goole, Yorkshire
Smith, William...Kettering
Smith, William...Littlehales, Newport, Shropshire
†Smith, W. B....Stoneleigh Villa, Leamington
Smithers, William...Sondes Place Farm, Dorking
Smyth, James...Peasenhall, Witham
†Smyth, John George...Heath Hall, Wakefield
Smyth, William...Little Houghton, Northampton
Smyth, Rev. William...Elkington Hall, Louth
Smythe, Sir C F., Bt....Acton Burnell, Shrewsbury
†Smythies, Carleton...Roman Hill, Colchester
†Smythies, George...Leintwardine, Salop
Sneezum, Thomas...Preston, Harrow-on-the-Hill
†Snell, John F....Great Bardfield Lodge, Braintree
Snewing, Charles...Holywell Farm, Watford
†Snoulten, Osborne...Woodville Hall, Dover
Snow, Rev. George D'Oyley...Pimperne, Blandford
Snowdon, William...Longford, Gloucester
Soames, Daniel W....Pinner, Watford
Solley, George Bushill...Monkton Court, Ramsgate
Somerset, J., M.D...Manor House, Milton, Pewsey
†Somerville, J. C....Dinder Ho., Wells, Somersetsh.
Souley, W....Kirby Moorside, Yorkshire
Sowerby, Francis...Aylesby, Great Grimsby
Spain, George...Hackling, Sandwich
Spanton, Robert...Little Thorns Farm, Swaffham
Spark, William...Shilton House, Coventry
Sparke, Alfred...Thorn Lane Foundry, Norwich
†Sparks, William...Crewkerne
Speakman, Thomas...Doddington Park, Nantwich
Spearing, John B....Moulsford, Wallingford
Spearing, William...Kennett, Marlborough
Spearman, H. J....Burn Hall, Durham
Spencer, Capt....Kirby Stephen, Westmoreland
Spencer, Earl...Althorp, Northampton
†Spencer, E....Bircher, Leominster
Spencer, Francis...Claybrooke, Lutterworth
Spencer, John...Corn Market, Doncaster
Spencer, J. W., jun....Whorlton Hall, Newc.-on-T.
Spencer, Samuel...Snarestone, Ashby-de-la-Zouch
Spicer, J. William...Esher Place, Esher
Spill, George...Old Farm House, Stepney Green
Spinks, Abraham...West Bilney, Lynn
Spooner, Prof. C....Roy. Veter. College, St. Pancra
Spooner, Thomas...Burton-upon-Trent
Spooner, Richard, M.P....Birmingham
Spooner, William Charles...Southampton
Spragge, Francis Hoare...Octon House, Torquay
Squarey, Elias P....Odstock, Salisbury
Squier, Samuel W....Horndon-on-the-Hill, Essex
Squire, Edward Frederick...Cross Hall, St. Neot's
Squire, William...5, Coleman Street, E.C.
Stable, Robert Scott...The Park, Wanstead
†Stables, W. A....Cawdor Castle, Nairnshire, N. B.
Stacy, Wm....Piccadilly House, Abingdon
Stafford, Thomas...Marnham, Nottingham
Stafford, Robert...31, Hyde Park Square, W.
Stainton, John...Dalby, Spilsby
Stallard, Jos....Redmarley, Newent, Gloucestersh.
Stallard, William...Brockhampton, Ross
Standing, Thomas...Fishergate, Preston
†Standish, W. Standish...Duxbury Park, Chorley
Stane, John Bramston...Forest Hall, Ongar
Stanford, Walter...Parham, Storrington, Sussex
Stanford, W., jun....Steyning Court Farm, Steyning
†Stanhope, J. B., M.P....Revesby Abbey, Boston
Stanier, J. E....Seaton, Wellington, Salop
†Staniforth, Rev. Thos....Storr's Hall, Windermere
Stanley, Edward...14, Grosvenor Square, W.
†Stanley, Lord, M.P....Knowsley, Prescot
Stanley, Henry...Upton, Shiffnall
Stanley, W. H. S., jun....21, Curzon St., May Fair, W.
Stansfeld, H. Hamer...1A, Basinghall Street, E.C.
Stansfield, W. R. C....Eshott Hall, Leeds
Stanton, Henry...79, Coleman Street, E.C.
Stark, Michael J....Duke's Palace Bridge, Norwich
Starkey, Major L. C....Wrenbury Hall, Nantwich
†Starkey, J. Bayntun...Spye Park, Chippenham
Starmer, Chas....Hogsthorpe Rectory, Alford, Linc.
Statham, Rev. R. J....Rectory, Tarporley
Statter, Thomas...Knowsley Hall, Bury, Lancashire
Stawell, Col. A....Kilbrittain, Bandon, Cork
Stearn, Samuel G....Brandestone, Wickham Market
Stead, Titus Bennett...Leeds
†Stedman, James...Lucton, Leominster
Stedman, Robert...Great Bookham, Leatherhead
Stedman, Wm....Bedstone Hall, Aston, Shrewsbury
Steedman, George...Hall Green, Birmingham
Steedman, Joseph...Meriden, Coventry
Stenning, Edward...Stratton House, Godstone
Stenning, William...Halsford, East Grinstead
Stenton, Henry Cawdron...Southwell
Stephens, Charles...Earley Court, Reading
Stephens, E....Trewornan, Wadebridge, Cornwall
Stephens, Rev. Ferd. T....St. Mawgan, Cornwall
Stephens, H. L....Tregenna Castle, Hayle, Cornwall
Stephens, J....23, Eastbourne Terr., Hyde Park, W.
†Stephens, Robert...Ive's Place, Maidenhead
Stephens, S. J....5, Charlotte Street, Portland Place
Stephenson, Marshall...Fourstones, Hexham
Sterriker, John...Driffield

†Stevens, John...Holywell Street, Oxford
Stevens, J. Curzon Moore...Winscott, Torrington
†Stevens, Rev. T....Bradfield Rectory, Reading
Stevens, William Carr...33, Mark Lane, E.C.
Stevens, William...Gatehampton, Reading
†Stevenson, Capt. C. B....Hennor House, Leominster
Steward, A. Benn...Chapel House, Whitehaven
Steward, Charles...Thurleston Lodge, Ipswich
†Steward, Chas....Blundeston, Lowestoft
†Stewart, Alexander J. R....Ard House, Donegal
Stewart, Arthur...Barton House, Gloucester
Stickney, William...Ridgmont, Hull
Stiles, Stephen...Shirburn Farm, Tetsworth
Stilgoe, Henry...Chapel Ascot, Southam
Stillwell, J. J. R....Fairfield, Chiddingfold, Surrey
†Stirling, William, M.P....Keir House, Perthshire
Stirling, Sir W., Bt....Burrs Wood, Tunbridge Wells
Stock, S....Blackley Hurst, St. Helen's, Lancashire
Stocker, J. P....93, Oxford Terrace
Stokes, Charles...Kingston, Kegworth, Derby
Stone, J. J...Ashton Vil., Wickham Rd., Up. Lewish.
Stone, John S....Newport, Monmouthshire
Stone, N. Chamberlain...Ayleston Hall, Leicester
†Stoneham, Frederick...Crayford
Stonehewer, W. S., jun....Brunswick Terr., Brighton
Stopford, W. Bruce...Drayton House, Thrapstone
Storer, C., M.D....Lowdham Grange, Nottingham
Storer, Rev. John...Hellidon, Daventry
†Storrar, Robert...Grittleton, Chippenham
Story, J. B....Lockington Hall, Derby
Stow, Arthur...Bredon, Tewkesbury
†Stowey, Augustus...Kenbury House, Exeter
†Stracey, Henry J....Rackheath Hall, Norwich
Strachan, J. M....Teddington Grove, S.W.
Strafford, Henry...13, Euston Square, N.W.
Strangway, Henry Bull...Shapwick, Bath
†Stratford, H.S...ThorpeLubenhamHl., MarketHarb.
Straw, Fred....Stones Place, Skellingthorpe, Linc.
†Strathallan, Visc...Strathallan Castle, Auchterarder
Stratton, George...Spinnymoor House, Durham
†Stratton, J. Locke...Turveston House, Brackley
Stratton, Richard...Stapleton, Bristol
Strelly, Richard Clayton...Buckland Hollow, Belper
Streeter, William...Sandersteed, Croydon
Strickland, Walter...Cokethorpe Park, Witney
†Strickland, Chas. William...Boynton, Bridlington
Strode, Geo. S....Newnham Park, Plympton, Devon
Stronge, Thomas...Cirencester
†Stuart, Lt.-Col. Wm., M.P....Kempston, Bedford
Stubbs, Chas....Preston Hill, Penkridge
Stubbs, John...Weston Hall, Stafford
Stuckey, H....Cothelstone, Bp.'s Lydeard, Taunton
Sturgeon, Charles...South Ockenden Hall, Romford
Sturgess, Thomas...Penshurst, Tunbridge
†Sturt, Hen. Chas., M.P....46, New Bond Street, W.
Stutfield, W....Hildersham Rookery, Cambridgesh.
Suffolk, Earl of...Charlton, Malmesbury
Summers, G....Stoke, Wake, Blandford
Sumner, Rev. C. V. H....Ringwould Rectory, Dover
Surman, J. Surman...Swindon Hall, Cheltenham
†Surtees, Henry Edward...Dane End, Ware
Surtees, Robert L....Redworth House, Darlington
Sutcliffe, Rev. Thos....Royd Ho, Heptonstall, York
†Sutherland, Duke of...Trentham Park, Newc.-u-L.
Sutton, John...Moston Manor, Sandbach
†Sutton, Martin Hope...Portland Place, Reading
Swaffield, Benj....Pilsbury, Ashborne, Derbyshire
Swaffield, Samuel...Ampthill Park, Bedfordshire
Swan, W. R....Wall's End, Newcastle-upon-Tyne
Swann, George...York
†Swete, John B....
Swinburne, T. W....Winchcomb, Gloucestershire
Swinnerton, Robert...Weddington, Nuneaton
Sworder, H....Hallingbury Hall, Bishop Stortford
Sworder, J....West Mill, Bury, Buntingford, Herts
Sworder, William...Tawney Hall, Romford
Sydney, Viscount...Frognal, Footscray, Kent
Sykes, Edmund...Mansfield Woodhouse, Notts
Sykes, John...Croes Howell, Wrexham, Denbighsh.
†Sykes, Sir Tatton, Bart....Sledmere, Malton
Symonds, Thomas Powell...Pengethley, Ross
†Symonds, Thomas Powell, jun....Pengethy, Ross
Symons, Thomas George...Mynde Park, Ross
†Synge, Francis Hutchinson...Dysart, co. Clare

T.

Tabley, Lord de...Tabley House, Knutsford
Tabrum, Litchfield...Boishall, Brentwood
Tait, Henry...Shaw Farm, Windsor
†Talbot, Henry...Cockfield Hall, Sudbury
Talbot, C. R. M., M.P....Margarn, Glamorganshire
Talbot de Malahide, Lord...Malahide Cas., Dublin
Talbot, Hon. Col. W. P....Honeybourne, Gloucester
Talbot, Wm....Lane House, Burton, Westmoreland
Talbot, Wm. H....Southport, Lancashire
Tallant, Francis...Bushey Grove Farm, Watford
Tanner, Henry...Victoria Road, Cotham, Bristol
Tanner, Joseph...Mudeford House, Christchurch
†Tanner, William...Patcham, Brighton
Tanton, E....Hill Farm, Torrington, Devon
Tapply, E. S....Bonnington, Hythe, Kent
Tasker, William...Waterloo Iron Works, Andover
Tattersall, E....1, Tattersall's Yd., Grosvenor Pl., S.W.
Tattersall, John...Great Ealing, W.
Tattersall, William...Kirkstall Bridge, Leeds
Tatton, T. W....Wythenshawe Hall, Manchester
Taunton, William...Redlynch, Salisbury
Tavendale, Joseph...Pendley Farm, Tring
Tawney, A. R....Banbury
Tayler, Rowland...Colchester
Taylor, Charles...The Green, Bromyard
Taylor, Sir Charles, Bt...Forest Lodge, Liphook
†Taylor, Chas. H....Bamburgh Friars, Belford
Taylor, Frederick...Worcester Park, Ewell
Taylor, F. M. S....Castle Taylor, Ardrahan, Galway
Taylor, George...Dudley, Staffordshire
†Taylor, George Edward...Oatlands, Leeds
Taylor, Henry T....Holmer House, Hereford
Taylor, James...Stretford Court, Leominster
†Taylor, J....Burnfoot House, Wigton, Cumberland
Taylor, John...Moreton Hall, Whalley, Blackburn
Taylor, John...Aston Clinton, Tring
†Taylor, Joseph...Bishop's Stortford
Taylor, Mark...Cleeve, Goring, Reading
†Taylor, R...6, Queen St. Pl., Upper Thames Street

Taylor, R. P....Adelaide Pl., London Bridge, E.C.,
†Taylor, Sam....Eccleston Hall, Prescot, Lancashire
†Taylor, Simon W....Erchfort Manor Ho., Devizes
Taylor, Thomas...Burleigh Villa, Wellington, Salop
Taylor, Thomas...Ashton House, Tetsworth
Taylor, T. Loombe...Starston, Harleston, Norfolk
Taylor, William...Harptree Court, Bristol
Taylor, William...Addington Lodge, Croydon S.
Taylor, Wm....Showle Court, Stoke Edith, Hereford
Taylor, William...Groby Cottage, Leicester
Taylor, William...Thingehill Court, Hereford
Tayton, William...Syderstone, Fakenham
†Tempest, C. Henry...Broomlands, Nantwich
Tempest, Colonel...Tong Hall, Leeds
Tempest, F. Roger...Ackworth Grange, Pontefract
Tempest, Sir C....Broughton Hall, Skipton, Yorkshire
Temple, Edward...Saltergill, Yarm, Yorkshire
†Templemore, Lord..Dunnoby Pk., Wexford, Ireland
Templeton, Andrew...Lismanny, Ballinasloe
Tench, John...Ludlow
Tennant, John...Riddings, Long Preston, Leeds
Tennant, Joseph Mason...Headingley, Leeds
Tennant, J. R....Kildwick Hall, Skipton, Yorkshire
†Tennant, Robert...Scarcroft Lodge, Leeds
Tennant, Thomas...Blenheim Terrace, Leeds
Terry, Rev. Stephen...Dummer, Basingstoke
Tevendale, Joseph...Pendley Farm, Tring
Thackeray, Capt....Junior United Serv. Club, S.W.
Thackwell, John Cam...Dymock, Gloucestershire
†Thew, Edward...Lesbury House, Alnwick
Thistlethwaite, Thomas...Southwick Pk., Fareham
Thomas, David...Brecon
Thomas, E. David...Welfield House, Builth, Brecon
Thomas, F. H....Hereford
Thomas, George...18, Redcliff Street, Bristol
†Thomas, G. T....Ermatingen, Thurgovie, Switzerl.
Thomas, John...Bletsoe, Bedford
Thomas, L. H....Caerffynnon, Talsarna, Carnarvon
Thomas, R. Goring...Lllysnewydd, Carmarthen
Thomas, Rees...Dolellan, Llandyssell, Carmarthen
Thomas, Thomas...St. Hilary, Cowbridge
†Thomas, Rev. W. J...Llan Thomas, Hay, Herefordsh.
Thomasson, William...Barnby Moor, East Retford
Thompson, Alexander...Kirknewton, Wooler
Thompson, Andrew...Keele, Newcastle-under-Lyne
†Thompson, Anthony...Cross, Whitehaven
Thompson, G. A....Kirkhouse, Brampton, Cumberl.
Thompson, Henry A....Lewes
Thompson, John...Paston, Coldstream
†Thompson, John...Badminton, Chippenham
†Thompson, John B....Anlaby, Hull
Thompson, Matt....Kirkby Stephen, Westmoreland
Thompson, Leonard...Sheriff Hutton Park, York
Thompson, W....12, Dunsford Place, Bathwick, Bath
†Thompson, William...Weymouth
†Thompson, W., jun...Thorpe-le-Soken, Colchester
Thomson, Guy...Old Bank, Oxford
Thomson, R. J....Grange, Kilmarnock
Thomson, Robert Thomas...Updowne, Sandwich
Thorn, James...Brackinburgh, Penrith
†Thornes, Joseph...Green House, Ossett, Wakefield
Thornhill, George...Diddington, Huntingdon
Thornhill, Obadiah...Barthomley, Crewe
†Thornhill, T....Riddlesworth Hall, Thetford
Thornhill, Wm. Capel Clarke...Rushton, Kettering
†Thornhill, W. P., M.P....Stanton Hall, Bakewell
Thornton, C. George...Marden Hill, Hertford
Thornton, Harry...Turvey, Newport Pagnell
†Thorold, Richard...Weelsby Hall, Grimsby
Thorpe, R. H....Temple, Selby
†Thorp, Thomas...Alnwick, Northumberland
†Thorp, Archd. T...Kemerton Rectory, Tewkesbury
Thorpe, J. Cole...Otley Ho., Walesby, Market Rasen
Thoyts, Mortimer G....Sulhampstead House, Reading
Thresher, Fred. R....Marsh Ho., Bentley, Farnham
Thring, Robert...9, Whitehall Place, S.W.
†Throckmorton, Sir W., Bt....Buckland, Faringdon
†Thurlow, T. Lyon...Baynard Park, Guildford
†Thurnhall, Henry...Royston, Herts
Thursby, Rev. F....Abington Rectory, Northampton
Thynne, F. George...Fleaford Lodge, Guildford
†Tibbits, Capt. J. Borlace..Barton Seagrave, Kettering
Tiffen, Joseph...North Skirlaugh, Hull
†Tighe, Rt. Hon. Wm. F....Inistioge, Ireland
Tilden, John...Ifield Court, Gravesend
†Tillard, Philip...Great Stukeley Hall, Huntingdon
Timm, Joseph...Champion Hill, Camberwell, S.
Timmis, Richard...Darlington St., Wolverhampton
Timson, Rev. Edward...Tatchbury, Southampton
Tinkler, Robert...Penrith
†Tinne, John A....Briarley, Aigburth, Liverpool
Tippler, Wm., jun....Roxwell, Chelmsford
†Todd, John...Mireside, Wigton, Aspatria, Cumb.
†Tollemache, H. B....Junior United Service Club
†Tollemache, J., M.P....Tilston Lodge, Tarporley
Tombs, John...Hatherop, Fairford
Tombs, J. King...Lanford, Lechlade
Tomkinson, William...Newcastle, Staffs.
Tomlin, H. Currer...St. Margaret's, Ware
Tomline, Col. G., M.P....1, Carlton House Terrace
Tomlinson, Capt. Frederick W....Leamington
Tomlinson, J. Edward...Whitbach, Ludlow, Salop
Tomlinson, Wm...Biggins House, Kirkby Lonsdale
Tompson, Edw. C. S....4, Beaumont St., Oxford
Tompson, H. Kett...Witchingham Hall, Norwich
Tompson, R. James...Cowley Peachey, Uxbridge
Tomson, James...Barnt Green, Bromsgrove
Tonge, Charles...Ashfield House, Lincoln
Tonge, W., sen....Chevening, Sevenoaks
Tooke, William...12, Russell Square, W.C.
Toomer, G. Edw....Hoaden House, Ash, Sandwich
Toplis, James...Boxted Farm, Colchester
†Torr, William...Aylesby, Great Grimsby
Toulson, John Parker...Skipwith Hall, Selby
Tovey, Robert...Fairford
Toward, Andrew...Osborne, Isle of Wight
Towell, Samuel...Rutland House, Newmarket
Tower, Christopher T....Weald Hall, Brentwood
Towgood, Edward...St. Neot's, Hunts
Townend, Thomas...Knockholt, Kent
Townley, Rev. Gale...Beaupre Hall, Wisbeach
Townsend, G. Barnard...The Close, Salisbury
Townsend, Hen....Rydinghurst, Cranley, Guildford
†Townsend, Thomas...Hillmorton, Rugby
†Townsend, Rev. C. G. G....Hatfield Peverel
Townsend, W. H...Shannon Court, Bristol

Townshend, Charles...Pulford, Chester
Townshend, G. H....Stoney Stanton, Hinckley
†Townshend, Marquis...Raynham Hall, Rougham
Traherne, G. M....St. Hilary, Glamorganshire
Treadwell, John...Waddesdon, Aylesbury
Trebeck, Thomas...Southwell
Treby, Henry Hele...Goodamoor, Plympton, Devon
Treby, Paul Ourry...Goodamoor, Plympton, Devon
Tredwell, John...Leigham Court, Brixton Hill
†Tredegar, Lord...Tredegar Park, Newport
†Treherne, Morgan...Gate House, Hurst Green
Trehonnais, R. F. de la...Central Hill, Up. Norwood
†Trench, Henry...Cangort Park, Roscrea, Ireland
Trench, W. S...Essex Castle, Carrickmacross, Ireland
Trethewy, Henry...Grampound
Trethewy, Henry, jun....Silsoe, Beds
Trevelyan, Sir W. C., Bt....Wallington, Newc.-on-T.
Trimmer, Charles...Alton, Hants
Trinder, Edward...Cirencester
Trinder, Thomas...Sandlin, Leigh Sinton, Malvern
Tripp, Arthur S....Esgair Hall, Shrewsbury
Trollope, Sir J., Bart., M.P....Caswick, Stamford
Trood, Edward...Matford House, Exminster
Trotter, Theodore...Greetwell House, Lincoln
Trotter, Thomas...Bywell, Newcastle-upon-Tyne
Trower, Capt. E. S....Stansteadbury, Ware
Trumper, Edward...Nuneham Park, Oxford
Trumper, Joseph...Lake End, Burnham, Bucks
†Tryon, T....Bulwick, Wansford, Northamptonshire
Tuck, Rev. G. R....Blofield, Norwich
Tuck, Henry...Shirley, Ringwood
†Tucker, Henry...Bourton Ho., Shrivenham, Berks
†Tuckett, P. D., jun....76, Old Broad Street, E.C.
†Tudor, Geo. S....Park House, Lapley, Penkridge
†Tull, Henry...Crookham, Newbury
†Tull, Richard...Crookham, Newbury
†Turnbull, John George...Pinner, Watford
†Turnbull, Rev. T. S....Blofield, Norfolk
Turner, E. R. T....St. Peter's Iron Works, Ipswich
Turner, Fred....St. Peter's Iron Works, Ipswich
Turner, George...Beacon Downs, Exeter
†Turner, Lieut.-Col. F. Henry...Gouray, Jersey
Turner, J. Singer...Chyngton Farm, Seaford, Lewes
Turner, John...Stanwell, Staines
Turner, John...Englefield, Reading
Turner, J. H...Little Horringer Hall, Bury St. Edm.
Turner, J. W., Hopton, Mirfield, Normanton
Turner, Philip...The Leen, Pembridge, Herefordsh.
Turner, P. Henry...Whitlocksworthy, Kingsbridge
†Turner, W. Beckett...Penleigh House, Westbury
†Turnor, Christopher...Stoke, Grantham
Turnor, Michael...Brereton, Rugeley
Turvill, G....Manor Farm, East Shalford, Guildford
Tuxford, Jos. Shephard...Skirbeck, Boston
Tuxford, Weston...Boston
Tuxford, William Weld...Boston
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Twining, F....Parbold Hall, Wrigtington, Wigan
Twitchell, Thomas...Willington, Bedford
Tyacke, James...Bonallack, Constantine, Cornwall
Tylden, Lt.-Col. Sir J....Milsted, Sittingbourne
Tyler, John...Layton, Essex
Tyler, Rev. Roper T....Llantrithyd, Cowbridge
Tyrell, Sir J. T., Bart....Boreham Ho., Chelmsford
†Tyringham, Wm. B...Tyringham, Newport Pagnel
Tyrrell, John...New Court, Topsham, Devon

U.

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†Umbers, Edward...Wappenbury, Leamington
Umbers, Samuel...Wappenbury, Leamington
†Umfreville, S. C....Ingress Abbey, Greenhithe
Underhill, W. S....Newport, Salop
†Underwood, Joseph...5, Hyde Park Gardens
Unsworth, John...The Thorn, Penrith
Unthank, John...Netherseales, Penrith
Upfill, Thomas S....The Wells, Bromyard
†Upperton, Robert...35, Steyne, Brighton
†Upton, Hon. Col. G. F...27, George St. Hanover Sq. W.
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Upward, A....
Urwick, Edward...Felton, Ludlow, Salop
†Usedom, the Baron von...Berlin

V.

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†Valle, Conde Del...Vergana Gurpoisea, Spain
Vallentine, R....Burcott Lo. Fm., Leighton Buzzard
Valpy, Robert Harris...Ilfracombe
Vanderstegen, W. H....Cane End House, Henley
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Vaughan, John W....Velinnewidd House, Brecon
†Vaughan, Nash V. E....Rhesta, Neath, Glamorg.
Vaughan, William Brettell...Ludlow
†Vaux, Lord, of Harrowden...Highams, Bagshot
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Waddington, John Horsey...Langrish, Petersfield
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†Wicksted, C....Thakenhurst, Cleobury Mortimer
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Wigan, Edm....Lapley Breewood, Wolverhampton
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